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TREASURES

What Earth and Hand Have Made

edited by David J. Goa

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TREASURES
What Earth and Hand Have Made

edited by
David J. Goa
with the assistance of
Robert S. Kidd

Frontispiece

Assorted artifacts and mineral specimens from the human and natural history collections of the Provincial Museum of Alberta.

Published on the occasion of Treasures, What Earth and Hand Have Made, an exhibition at the Provincial Museum of Alberta, June 1991.

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A
SYSTEM
OF
MINERALOGY
DANA
STERLING
SILVER
GOLD
PLATED
ORTHOCLASE

Contents

Diamond-encrusted, 14 karat, gold presentation snuff box with painted ivory portrait of the ruler of Saxony, made in the 19th century.

Foreword

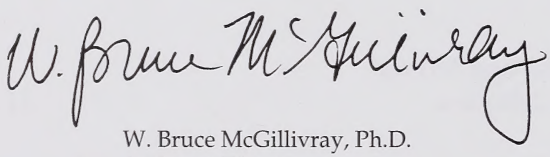
The treasures of the earth sustain the body, run economies, and fire the imagination. Even single words like iron, gold, jade, or diamond are alive with images. Who does not dream of finding a map where X marks the site of buried riches?

In the exhibit and this accompanying publication ***Treasures, What Earth and Hand Have Made***, the mystical and the scientific appeal of minerals and metals is explored. In each chapter of the publication a new perspective is presented.

Reading through the book, one cannot help but marvel at the enduring beauty of the treasures of ancient cultures prized today as then. Or consider the power of gold that drove explorers over different continents and across the centuries.

The geologist classifies mineral as species, hinting at their "living" qualities like growth and variation. The museum preserves and studies them to unlock their secrets. The numismatist brings us back from electronic banking to the significance of cold, hard cash. And the collectors tell us the story of a quest, as much a treasure for them, as the prize.

What we value is personal, in the final analysis, and these chapters provide glimpses of what seven authors treasure from the earth's riches.



W. Bruce McGillivray, Ph.D.
Assistant Director,
Natural History
Provincial Museum of Alberta

Preface

Treasures, What Earth and Hand Have Made is published in conjunction with an exhibition that draws together many of the finest mineral specimens and metal artifacts in the Provincial Museum of Alberta. We are pleased to show, often for the first time, specimens from the Museum's Geology program collection, one of Canada's superb public collections of mineral crystals and gemstones. Magnificent artifacts of jade, bronze, gold, and silver represent the Ernest E. and Gertrude Poole Collection at the Museum. A number of fine coins and medals are drawn from the excellent collection assembled by Dr. Carl O. Nickle.

In this publication we introduce the reader to the role that minerals and metals have played in the human imagination, from ancient cultures to those of the modern day. The three major collections in the exhibit are surveyed in essays on **The Ernest E. and Gertrude Poole Collection**, **The Carl Nickle Collection**, and **the collection of the Geology program**.

Over the past years, Rod and Helen Tyson have collected minerals in many parts of the world and we join them on one of their expeditions through their essay: "A Season of Mineral Collecting."

The continuing interest of John and Barbara Poole in **The Ernest E. and Gertrude Poole Collection** and in the ***Treasures*** exhibition is gratefully acknowledged. We also thank the Honourable Justice Mr. Neil Primrose, a friend who shared the Poole's collecting interest and former member of the Poole Foundation, for the information and insight he has provided on the collection.

Various curatorial programs of the Museum have been ably assisted in the preparation of material for the exhibition and the catalog. We appreciate the fine work of Andrew Locock, Gladys Serafino, Craig Sobat, Gail Chin Bryant, Doreen Rockliff, and Margot Brunn. The exhibition was designed by Bryan McMullen.

We gratefully acknowledge for their loans to the exhibition: the Bank of Nova Scotia, Karen Cantine, Echo Bay Mines Ltd., Dr. Roger Morton, Sherritt Gordon Ltd., Tyson's Fine Minerals Inc., and George Woollett of Trigg, Woollett and Olson Consulting Ltd.

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MINERALS, METALS AND THE IMAGINATION

David J. Goa

The crust of the earth is a fascinating treasure house. Since time immemorial we have searched the highest mountains and the depths of the earth for precious minerals, metals, and gemstones. Some minerals have an innate beauty and provide human culture with elegant objects. From metals we have made money and many of our finest tools. In gemstones, human cultures have found worlds of beauty and wonder. In human hands these gifts of nature have transformed history and culture.

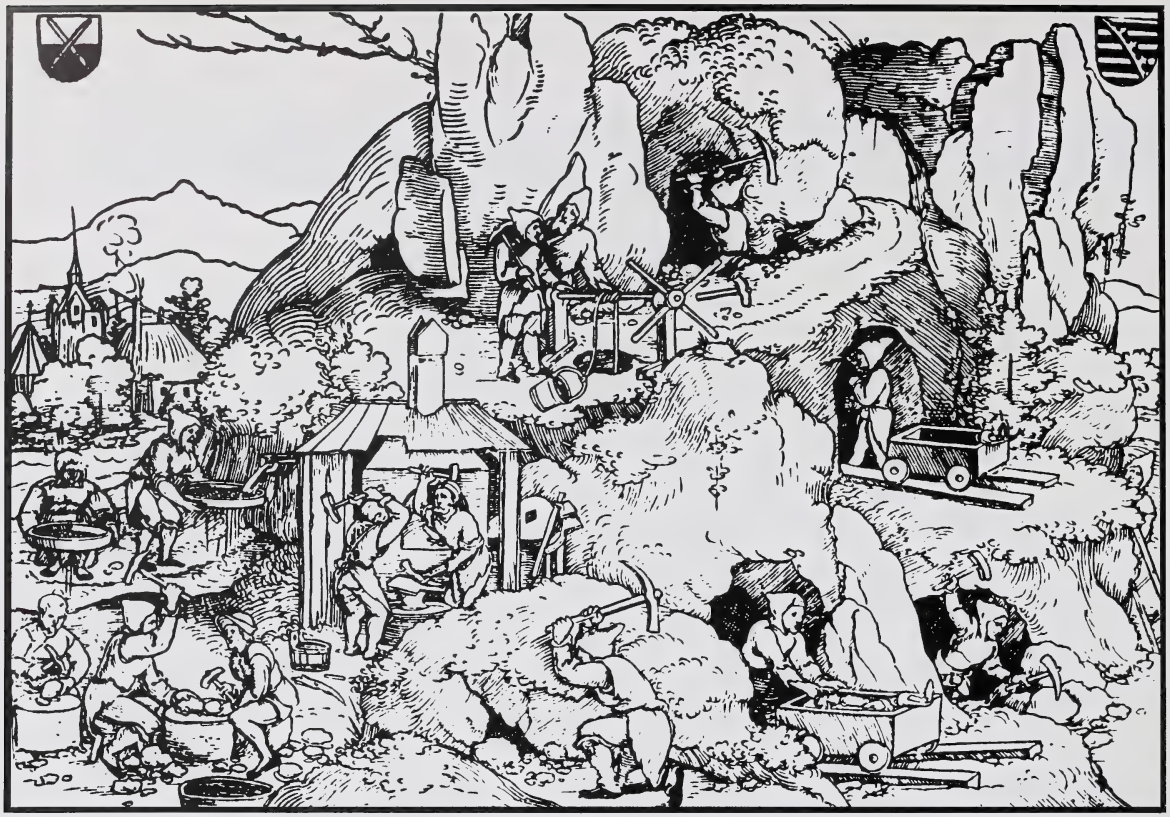
The Earth

There are over a thousand references to the earth in the Bible and tens of thousands in the sacred texts of the world's cultures. Science has devoted most of its energy to understanding the earth and all forms of life that inhabit it. Modern ecological movements have again drawn our attention to the fragile character of the earth and to its wonders and beauty.

The earth is understood by many cultures as the source of life, a reservoir of sacred forces. The opening lines of a prayer to Awitelin Tsita, the earth divinity of the Zuni of New Mexico, express this sentiment:

> May the rain-makers water the Earth-Mother that she may be made beautiful to look upon.
> May the rain-makers water the Earth-Mother that she may become fruitful and give birth to her children and to all the world the fruits of her being that they may have food in abundance.
> May the Sun-Father embrace our Earth-Mother that she may become fruitful, that food may be bountiful, and that our children may live the span of life, not die, but sleep to awake with their gods.
>
> [Matilda Coxe Stevenson, "Ethnobotany of the Zuni Indians," 1915. In *Annual Report of the Bureau of Ethnology,* Washington, D.C. 1915, p.37].

Seeing the earth as a Mother is common indeed. This image has been developed in some of the cultures of the Mediterranean and



This woodcut by Erhard Schön (1525) shows various aspects of gold mining in Saxony.

Oriental worlds to speak of the fullness and completeness of the earth. In the Japanese texts recorded in the *Kojiki* and *Nihongi*, the earth formed a perfect and androgynous totality within an egg-like chaos. Slowly, out of the earth, the heavens formed, and the union of earth and heaven gave birth to all beings in the world. This divine androgyny shows the earth as the primordial stage of creation.

According to Hesiod, "Earth (Gaia) herself first of all gave birth to a being equal to herself who could overspread her completely, the starry heaven (Ouranos) who was to present the blessed gods a secure throne forever" (*Theogony* 5126 ff.). This divine couple brought the gods, the cyclopes, mythical monsters, and arrogant children into being. The earth existed before the heavens in ancient Greek mythology, and the limitless creative power of the earth is sung about in the Homeric Hymns.

> It is the earth I sing, securely enthroned, the mother of all things, venerable ancestress feeding upon her soil all that exists....To thee it belongs to give life to mortals and to take it from them.
> [*Hymn to Earth* 1 ff.]

In other mythologies, those from Oceania, Indonesia, Micronesia, Asia, Africa, Europe, and the Americas, the role of the earth in creation is richly depicted as a marriage with heaven, a marriage from which flow all the beings of life, an endless fecundity. The earth is a womb and in its marriage with heaven it becomes fruitful and brings forth all manner of things.

The rich minerals and metals are given birth by the earth. It is in the ancient Indian writings on minerals that hark to the Vedic mythological tradition that we first encounter the description of diamond as "ripe," crystal as "unripe," and the emerald, still wrapped in its stone womb, as only an embryo. Base metals and unrefined ores are not fully "ripe." The work of smiths and alchemists may imitate, hasten, and complete the powerful functions of the earth mother and bring these gifts of the earth to completion.

The Alchemist Completes the Work of Nature

> If there were no exterior obstacles to the execution of her designs, Nature would always complete what she wishes to produce.... That is why we have to look upon the birth of imperfect metals as we would on abortions and freaks which come about only because Nature has been, as it were, misdirected or because she has encountered some fettering resistance or certain obstacles which prevent her from behaving in her accustomed way.... Hence although she wishes to produce only one metal, she finds herself constrained to create several. Gold and only gold is the child of her desires. Gold is her legitimate son because only gold is a genuine production of her efforts.
>
> [*Bibliotheques des Philosophies chimiques*, 1741].

There are many definitions of alchemy but perhaps the broadest is that of H.J. Sheppard who said that "Alchemy is the art of liberating parts of the Cosmos from temporal existence and achieving perfection which for metals is gold, and, for man, longevity, then immortality, and finally, redemption."

In European literature this esoteric discipline first made an appearance in the twelfth century. This medieval quest for a means of transmuting base metals into gold, for a universal cure, and for the "elixir of immortality" has come down through the centuries to the modern period. The alchemist's quest was not scientific in nature but, rather, it was a spiritual quest concerned with liberating the imperfect life of the natural order.

An Alchemist, from an engraving dated 1576.

This preoccupation is found in the ancient traditions of Taoism in China, in Indian Yoga and Tantrism, in the *gnosis* of Egypt, in the Hermetic and esoteric schools of mysticism in Islam, in the Western Middle Ages and Renaissance Hermeticism and Christian and sectarian mysticism, and in Qabbalah. The goal of alchemy is akin to that of the great religious mystical traditions: the liberation of nature and self.

Behind alchemy is the concern of human beings, ancient and modern, to influence the temporal nature of matter and bring about desired change. Ore grows in the depths of the earth, and the miner, metallurgist, and alchemist intervene to hasten its maturation. Ore, said the alchemists, is like embryos, and to participate in the process of fruition is to participate in a kind of obstetrics.

The central aim of alchemy was the transformation of ordinary metals into gold. The Chinese first argued in the second century BC that baser metals develop through time into the highest metals, silver and gold. The alchemists endeavored to make an elixir that could be poured onto base metals, perfecting and completing them by bringing them to the full "maturity" of gold and silver. The elixir would speed up the natural process of the formation of gold and silver through the various

stages of base metals, quicken the natural growth, and bring the "imperishable splendor" of gold, as John Ruskin called it, into existence. The motivation behind the alchemists' art, however, was to master cosmic and human time, to find a way to extend life, perfect it, and bring human beings closer to immortality. If properly applied, the Elixir that would bring the base metals to the state of "imperishable splendor" the alchemists dreamed, would also bring human life to a perpetually youthful state. The degeneration of the body associated with aging would finally be at an end. The eminent historian of religion, Mircea Eliade, in his book *The Forge and the Crucible, The Origins and Structures of Alchemy* (1971) suggests that this dream of the perfection of nature was the drive behind the nineteenth century's myth of infinite progress, and continues to be a powerful force in contemporary society.

> The myth of the perfection and redemption of nature has survived in camouflaged form in the Promethean program of industrialized societies, whose aim is the transformation of nature, and especially the transmutation of matter into energy. It was also in the nineteenth century that man succeeded in supplanting time. His desire to accelerate the natural tempo of organic and inorganic beings now began to be realized, as organic chemists demonstrated the possibility of accelerating and even eliminating time by preparing in laboratories and factories substances that would have taken nature thousands of years to produce. With what he recognizes as most essential in himself —his applied intelligence and capacity for work— modern man takes upon himself the function of temporal duration: in other words, he takes on the role of time.

Gold's Imperishable Splendor

Gold is immune to corrosion and seems to shine with its own light. Among the most widespread symbols in the history of culture, it has often been a symbol of life and the spirit, and of perfection and immortality. Gold objects were discovered in the tomb of Tutankhamen in Egypt and with the burials of the rulers of ancient Peru. In ancient China gilded images of the Buddha marked the quality of the Buddha's "enlightenment." Golden Christian icons, chalices, and crosses identify the sanctity of Christ. Within the rich imagery of Christian civilization, Christ is incorruptible and the perfection of nature as well.

This use of gold as the standard by which we measure the richness and perfection of things persists down to modern times. The United States of America, for example continued to measure and insure its currency through a "gold standard" into the 1960s, and presentation pieces honoring a person's life and work are often made or embellished with gold. We also crown kings and queens with gold and speak of the most compassionate human beings as having "hearts of gold." And, when many marry in Western culture, they seal their union with a golden ring.

Silver and gilt decorated chalice by Francois Ranvoyse, late eighteenth or early nineteenth century AD. The Ernest E. and Gertrude Poole Collection.

Silver, as Pure as the Crescent Moon

Silver holds a similar fascination for human beings. Its faultless brilliance and the process of purifying it in the refiner's fire has led to its broad use as a symbol of purity and, in some historical contexts, a symbol of chastity. This association continues in the gift of rings exchanged by lovers as sign and symbol of their fidelity and infinite love.

Silver chalice by Jonas Schindler, late eighteenth century AD. The Ernest E. and Gertrude Poole Collection.

Silver is intimately connected with a broad range of lunar mythologies in the history of culture. Perhaps the most graphic example is the Egyptian goddess Isis, Queen of Heaven, whose hieroglyph, a crescent, has become the standard symbol for silver.
Isis was one of the principal goddesses in the ancient Egyptian pantheon, the daughter of Geb and Nut ("earth" and "sky") and the wife of Osiris and mother of Horus. She played an important role in the mortuary cult of Egypt, which has given us the largest burial tombs in the world, the pyramids. She was queen of the dead and patroness of childbirth, and we know about her from the ancient Egyptian writings: the *Pyramid Texts* and a later funerary text called *The Contendings of Horus and Seth.* She assumed the symbolic elements associated with the early mother goddess and the goddess of love and had many temples dedicated to her, most notably on the island of Philae in Upper Egypt. The cult of Isis was the last pagan cult in Egypt to survive the beginnings of Christianity. Historians suggest this had to do in part with the negotiations for peace between the Blemmyes of Nubia (Egypt) and

the Roman commander in Egypt in AD 451, which guaranteed the local population access to the temple of Philae. It was not until the sixth century, when the Roman Emperor Justinian was finally able to close the temple, that the conversion of Egypt was complete.

But was the conversion complete? From a religious perspective it is safe to assume that the cult of Isis persisted with such tenacity because of its powerful associations with the dead, the earth, and with love. Indeed, in the iconography of early Christianity we see the crescent moon of Isis shown with the Christian Queen of Heaven, the Virgin Mary. The crescent motif persists in icons of the Eastern Church and on grave markers. The meaning of purity and chastity associated in the imagination with the shimmering silver companion of the night sky, of love and death, persists to this day.

Chinese *ruyi* sceptre, snow-flecked white jade carved with lotus, bird, and water decoration, Qing Dynasty, possibly Kangxi Period, seventeenth to eighteenth century AD. The Ernest E. and Gertrude Poole Collection.

Jade, The Emperor's Insignia

During the Zhou dynasty (ca 1221-1226 BC) in China, jade objects symbolized the sacred kingship of the Emperor and were used as sacrificial offerings to the Lord on High and to the Sovereign Earth deity. The Emperor alone had the privilege of wearing the rare white jade, which came to symbolize his high office. In the *Chou li*, the book of state rituals, the master of religious ceremonies is instructed to use six jade objects in the annual festivities of homage to Earth and Heaven and to the four cardinal points. A flat, doughnut-shaped jade disk called *pi* represents Heaven, while the Earth is symbolized by a jade tube, hollow on the inside and square on the outside. The *pi* has remained a significant symbol in Chinese religious tradition.

Jade was understood to embody the power of Heaven and would prevent the decay of the body. It played an important role in funeral practice, with wonderful pieces found regularly in coffins uncovered by archaeological explorations. The jade objects have been placed to cover the openings of the body with the hope of preventing putrefaction. Cicadas carved of jade are often found buried with dignitaries. The song of the cicada marks the awakening of spring, and a jade cicada was placed on the tongue of the deceased as symbol of immortality and renewal.

Jade is found in the Olmec culture of the Gulf coast of Mexico, the first American civilization. The use of jade in burial practices is also found in Mesoamerica among the Maya, notably as a valuable object worthy of offering to the gods at the traditional pilgrimage site in Yucatan, the sacred well of Chichen Itza. The Aztec, like some Chinese alchemists, appear to have used jade for medicinal purposes as well, out of the common belief that it possessed healing and life-giving powers.

The Lore of Precious Stones

Gemstones, because of their beauty and particular properties, have been given magical, religious, and spiritual significance in many cultures. One of the earliest lists of the symbolic significance of gemstones comes from the Bible. The twelve tribes of Israel each have a precious stone associated with them, and the vestments of the high priest in the Temple are adorned with onyx, sard, topaz, emerald, sapphire, diamond, and others (*Exodus* 28 and *Ezekiel* 28). The Christian vision of the New Jerusalem (*Revelation* 21) is of a bejewelled city, its foundation and twelve walls all formed of precious stones.

> And he carried me away in the spirit to a great and high mountain, and showed me that great city, the holy Jerusalem, descending out of heaven from God, Having the glory of God: and her light was like unto a stone most precious, even like a jasper stone, clear as crystal . . . . And the wall of the city had twelve foundations, and in them the names of the twelve apostles of the Lord . . . . And the building of the wall of it was of jasper: and the city was pure gold, like unto clear glass. And the foundations of the wall of the city were garnished with all manner of precious stones. The first foundation was jasper; the second, sapphire; the third, a chalcedony; the fourth, an emerald; the fifth, sardonynx; the sixth, sardius; the seventh, chrysolyte; the eight, beryl; the ninth, a topaz; the tenth, a chrysoprasus; the eleventh, a jacinth; the twelfth, an amethyst. And the twelve gates were twelve pearls; every gate was of one pearl: and the street of the city was pure gold, as it were transparent glass.

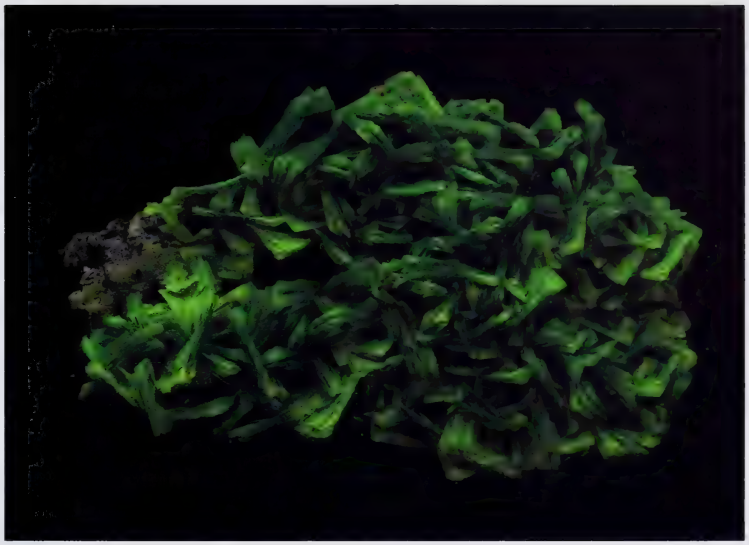
Since ancient times the signs of the Zodiac have each been associated with a gemstone, and many of these have been understood to have particular powers of curing or cursing. In the medieval period these stones were often engraved in the image of a serpent or frog, a totem image of their power.

The trade in gems that are thought to have medicinal and therapeutic powers has been brisk from ancient time to the present. Pliny the Elder (AD 23-79) in his massive study, *Historia Naturalis,* voiced what is perhaps the first recorded sceptical comment on the power of gems to cure disease. The color of gemstones also was thought by some ancients to be efficacious in the curing of particular ailments. Carnelian, garnet, ruby, and spinel, all red stones, for example, were used by Romans in the treating of inflammation and bleeding. In some cases gems were swallowed as part of a cure. Camillus Leonardus gives an account of such cures in his *Speculum Lapidum,* written in 1502. Amber he says, "naturally restrains the flux of the belly; is an efficacious remedy for all disorders of the throat. It is good against poison. If laid on the breast of a wife when she is asleep, it makes her confess all her evil deeds." Amber was given all the powers of an antibiotic, malachite was used as a local anesthetic, and sapphire cured boils.

The crowns and sceptres of kings and queens, the ornaments of the rich and mighty, sparkle with jewels. The use of beautiful stones in the adornment of presentation and ritual pieces of every sort continues to mark not only wealth, power, and prestige, but the joy the human imagination takes in these remarkable gems that earth and hand have made.

MINERALS AND METALS: The Earth's Treasures

Ron Mussieux



Platy crystals of meta-autunite, a brightly colored uranium mineral from the Daybreak mine, Spokane County, Washington.

Although humans have made use of mineral resources from the Earth's crust as far back as the cultural record takes us, geology, the scientific study of the Earth, only developed in the late eighteenth century. Initially, collecting and research were restricted to the surface portions of the Earth's continents. During the last century, however, geologists were able to dredge rock samples from the ocean floor. Since 1900 geologists have obtained rock samples from the upper portions of the crust itself by drilling. With the increasing application of numerous scientific instruments, our knowledge of this planet is growing rapidly.

Plate Tectonics: The Grand Design

During the past 30 years, a revolution in the earth sciences has captured the attention of the public as well as the scientist. Plate tectonics is an all-embracing theory that interrelates a variety of geological processes and events. According to this theory the earth's crust consists of a number of mobile plates, comprising whole or partial continents and ocean floors. Over millions of years, the movements of these plates can cause the splitting of continents and the opening and closing of ocean basins. Interactions between plates are the main causes of earthquakes and volcanic eruptions and are responsible for forming

the world's major mountain belts.

The earth's interior is extremely hot, and thermal currents within this interior are thought to cause the movement of the crustal plates. Over the entire surface of the planet there are areas where the crust is being created and areas where the crust is being destroyed. The net result is the recycling of the crust as the earth constantly re-combines elements to form new minerals.

A Matter of Terms

"Rock," "mineral," and "stone" are all terms that the public and the popular media have used to describe the solid substance that makes up the earth's crust. To the geologist, "rock" and "mineral" have fairly specific meanings, but the term "stone" is generally avoided because it lacks a specific definition.

Rocks are the large masses of solid material that make up the crust. They form the spectacular mountains of Jasper and Banff as well as the badlands of the Red Deer River valley. Most rocks are composed of a number of minerals such as the quartz, feldspar, and biotite that make up granite. Others are composed of a single mineral such as calcite, which forms the rock marble. There are many rock types, but they are generally classified into three groups depending on how they were formed: igneous - rocks formed by the cooling and hardening of molten material; metamorphic - rocks that were changed by high pressures and temperatures without melting to form a new rock; and sedimentary - rocks formed at the earth's surface by the deposition and hardening of fragments from pre-existing rocks or by the deposition of chemical precipitates.

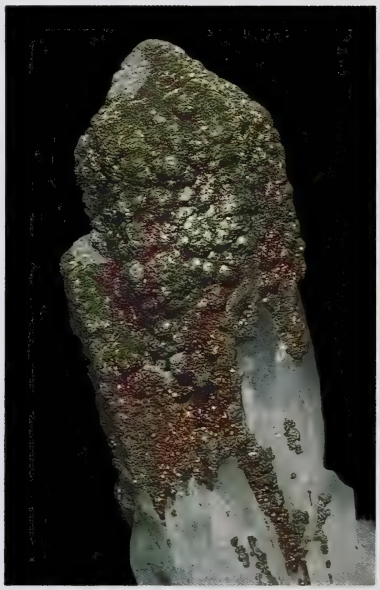
Minerals are naturally occurring elements and chemical compounds. They are inorganic; that is they are not produced by living organisms. Most minerals have characteristic chemical compositions and an orderly internal arrangement of atoms. Ninety-two elements are found in nature, but they combine to form over 3,500 different minerals. Less than 100 of these minerals are common and form the bulk of the earth's crust. Some minerals are so rare that they are found in only one locality in the world, and others have been found only in microscopic amounts.

Mineral Crystals

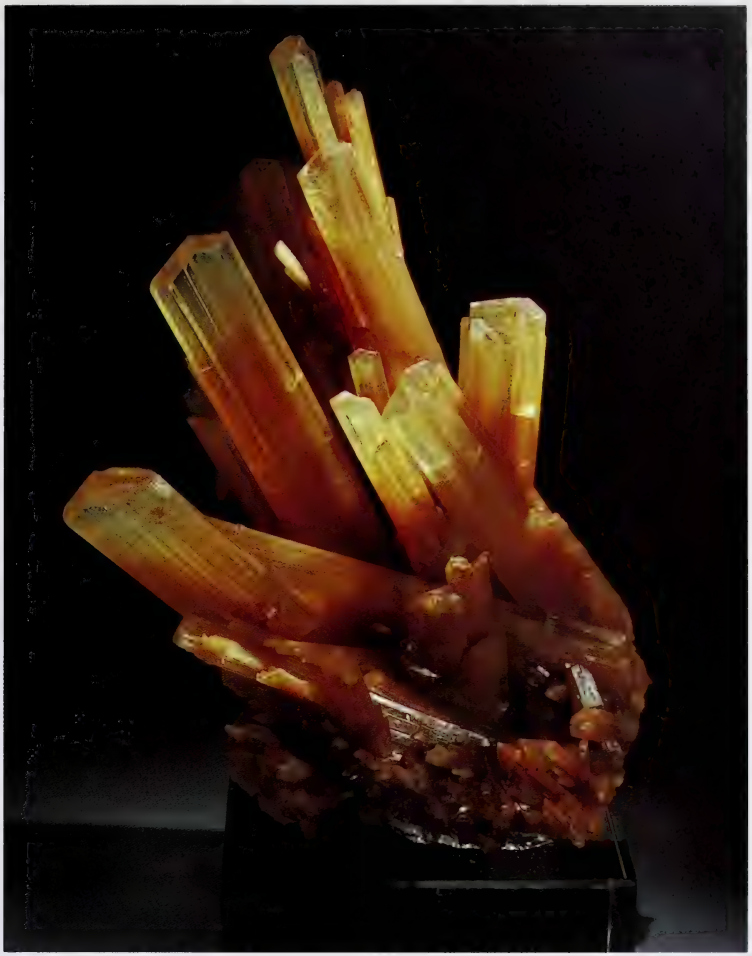
The fine mineral specimens acquired by collectors or displayed by museums often have sharp-edged, flat faces arranged in a variety of geometrical forms. These mineral crystals are sometimes thought to have been cut and polished like gemstones. This is not true, however, as the faces of the crystals are the result of natural growth and are an external expression of the ordered arrangements of atoms within.

Most people think of growth as a property only of living organisms, but minerals grow or crystallize by totally inorganic means. Growth occurs when atoms or groups of atoms bond together on the surface of a crystal, building an orderly structure. Minerals can often form hollow or "hopper" crystals because growth occurs more quickly along the edges and corners.

Mineral crystals can form from atoms in liquids such as water solutions or molten rock. Other minerals grow from vapors and still others in solid rock. Minerals such as quartz, biotite, and a variety of feldspars crystallize slowly out of molten rock (magma) to form granite. At the opposite extreme, salt crystals will grow at the earth's surface



Rounded growths of marcasite coating the tip of a quartz crystal, specimen from Ojuela mine, Mapimi, Mexico.



Excellent crystals of gypsum from Naica, Chihuahua, Mexico.

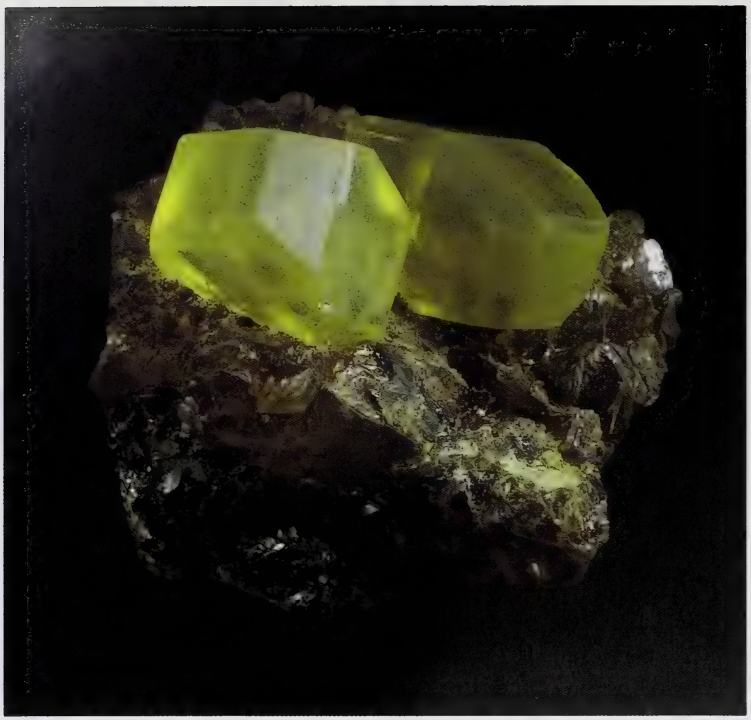
with the evaporation of sea water. Sulphur crystals can grow directly from sulphur-rich gases in the vicinity of volcanic vents.

Very fine mineral crystals are rare in nature, and perfect crystals probably do not exist. Factors that affect the growth of crystals include temperature, pressure, the correct supply of necessary atoms, and the availability of space to grow. In nature it is very unlikely that all these factors could remain constant throughout the growth life of the crystal.

Despite this difficulty, however, some very large crystals have been found in nature. The world's largest authenticated crystal is a beryl specimen from Malagasy Republic (Madagascar) that is 18 metres in length, 3.5 metres in diameter, and 380 tonnes in weight. The Etta mine in the Black Hills of South Dakota has several spodumene crystals measuring up to 12 metres in length and weighing many tons. These are referred to locally as "logs." These same mineral species, however, are also found as crystals so small that a microscope is needed to study them.

Synthetic Crystals

Since the beginning of the twentieth century, scientists have made great strides in producing synthetic crystals. Technically these are not



Fine, almost transparent, crystals of sulphur from Agrigento, Sicily.

minerals by our original definition, but many are essentially identical to mineral crystals. In the field of gemmology, scientists have been able to produce synthetic diamonds, rubies, sapphires, emeralds, opals, and a variety of others. Synthetic gemstones can be superior to natural gemstones in color, clarity, and size. Interestingly, it is the impurities, mostly solid, liquid, and gas inclusions, in gemstones that allow the gemmologist to distinguish the much more valuable natural gemstones from the more perfect, but less valuable, synthetics.

Scientists have also synthesized crystals that have no counterparts in nature in order to imitate gemstones. An example would be yttrium aluminum garnet imitations of diamonds. Synthetic quartz crystals are valuable in the manufacture of watches and communication equipment, while synthetic rubies are used in lasers.

Value of Minerals to Mankind

Minerals composing the earth's crust are the primary resources on which our material world is built, and without them civilization as we know it could not exist. Minerals affect almost every aspect of our lives, and today the average North American is the largest consumer of minerals the world has ever known. Our consumption of minerals is increasing rapidly: in the last 50 years we have used more minerals than have been consumed in all of mankind's previous history.

Mineral extraction is extremely important to the world's economy. Canada is the third largest mineral-producing country in the world. In 1987 Canada was the world's largest producer of nickel, zinc, and uranium concentrate; the second largest producer of asbestos, gypsum, and potash; the third largest producer of gold, aluminum, cadmium, and titanium; and the fourth largest producer of copper, lead,

molybdenum, cobalt, and silver.

The earth's resources are classified into three major groups: the fuels, nonmetallic or industrial minerals, and the metallic minerals.

Fuels

The fuels, sometimes referred to as mineral fuels, include petroleum, natural gas, and coal. As these resources are derived from organic materials, they are technically not minerals. These fuels are necessary to heat our homes, run our vehicles, and power our factories. They are also the feedstock of our petrochemical industries.

Industrial Minerals

The industrial minerals include all the minerals mined for some purpose other than extracting a metal. This is the largest of our three groups and would include numerous mineral species that could be associated with one or more of the following industries: construction, chemicals, fertilizers, ceramics, refractories and fluxes, abrasives, insulation, pigments and fillers, and gemstones.

Synthetic pink star sapphire gemstone.

A number of industrial minerals are formed by the evaporation of saline solutions and are termed "evaporites." Halite, or rock salt, from Alberta and Saskatchewan, from Searles Lake in California, and from the salt mines of Germany and Poland are examples. Saskatchewan has the world's largest deposits of potash salts, which are used primarily in the fertilizer industry. A group of unusual borate minerals from Death Valley, California, has been mined since the 1850s, primarily for soap, fertilizer, medicine, and flux. This deposit was made famous in the United States by the 20-mule team borax wagons pictured on borax soap boxes.

Alberta is one of the largest producers of sulphur in the world, primarily from sour gas fields in the western foothills. Sulphur is used in fertilizers, chemicals, and the paper industry. Sulphur crystallizes directly from gas vents in volcanic regions and from the alteration of other sulphur-rich minerals. The finest translucent yellow crystals are from Sicily.

An under-appreciated industrial mineral is gypsum. It is mined from a number of deposits across Canada primarily to produce gyprock wallboard used in the construction industry. Most of the gypsum occurs in thick, massive beds that rarely contain well-formed crystals. Fine, clear crystals of a type of gypsum called selenite can be found in a number of Alberta localities, but the most spectacular specimens come from Mexico and Australia. Compact, fibrous gypsum is often used for ornamental carving and is called alabaster.

Canada is a major world producer of asbestos. Asbestos includes a number of minerals, all of which have parallel flexible fibres with excellent insulating properties. Asbestos is used in fire-proof clothing and brake linings, and it is sprayed on buildings as insulation. The Jeffrey mine at Asbestos, Quebec, is famous not only for chrysotile asbestos, but also for its other fine mineral specimens, including cinnamon-colored garnets and green and purple vesuvianite crystals.

Mimetite, a colorful lead mineral, from San Pedro Corralitos, Chihuahua, Mexico.

Metallic Minerals

The best known group of earth resources is the metallic minerals.

A few metals are found in an uncombined state in nature and are part of a group of minerals known as native elements. These metals

include gold, silver, copper, lead, mercury, platinum, iron, arsenic, antimony, and bismuth. A few of these metals, particularly native copper and native gold, were among the first minerals used by human beings. Gold was always prized for its beautiful color, for its softness that allowed it to be shaped into jewellery, and for its resistance to corrosion. Copper was appreciated by some for its aesthetic properties, but it was also fashioned into tools and weapons.

Copper artifacts were manufactured in North America some 5,000 years ago from the famous native copper deposits of northern Michigan. Since 1845, over five million tons of copper were mined from this location. The Museum collection includes an outstanding specimen of rare native copper crystals, as well as a five foot sheet of native copper.

The Museum collection also contains a spectacular group of native gold specimens from the Bralorne mine in British Columbia and outstanding native silver specimens from Port Radium, Northwest Territories, and Cobalt, Ontario.

Most metals, however, occur as compounds in a variety of minerals. By 3,500 BC people had learned how to smelt copper in a clay-sided furnace from copper ores such as malachite. Malachite, a green-colored copper carbonate, was powdered by ancient Egyptians for use as a cosmetic and as a green paint. Today malachite is a favored mineral for collectors and is frequently carved as an ornamental stone.

Most of the metals vital to modern civilization are recovered from minerals that are compounds. These metals include iron, lead, zinc, copper, aluminum, tin, nickel, and uranium.

Metallic minerals are often referred to as "ore" minerals, and frequently they do not form attractive mineral crystals. On rare occasions, however, spectacular specimens are recovered, such as the fine galena (lead ore) crystals from the Sweetwater mine, Missouri, or the sphalerite (zinc ore) crystals from the Elmwood mine in Tennessee or the Nanisivik mine on Baffin Island.

Copper, lead, and zinc have characteristic colors and lustres. However, most people are astonished by the variety of colors and crystal shapes in which ore minerals of these metals can occur.

Although minerals are critical to modern civilization, they are also the raw materials that artisans have fashioned into objects of beauty. Fine mineral crystals themselves can be considered art objects. Their color and form are often magnificent. Many are rare indeed and have come about through a lengthy and complex geological process.

TREASURES

in Jade, Bronze, Silver, and Gold

The Ernest E. and Gertrude Poole Collection

TREASURES IN JADE, BRONZE, SILVER, AND GOLD

The Ernest E. and Gertrude Poole Collection

Craig Sobat

with an introduction by Catherine C. Cole

The Provincial Museum of Alberta is the custodian of an extensive collection of decorative arts acquired over many years by Ernest E. and Gertrude Poole. Ernest Poole's interest in collecting art began as a child in Prince Edward Island, where he collected the prints of English artist William Henry Bartlett. His enthusiasm grew through the years, and after his marriage in 1913 to Gertrude Annear, also a P.E.I. native, it was shared with his wife. Although their collecting interests were primarily Canadian painting, Georgian silver, early English china, and Asian objets d'art, the collection given to the Provincial Museum in the mid 1970s also includes tribal artifacts from North and South America, furniture, firearms, and reference material.

Ernest Poole was born in Woodville Mills, P.E. I., in 1884. The son of a mill owner, he spent much of his youth in the mills. As a student he made his first trip to the west, working as a carpenter in Manitoba in the summer of 1903. He then studied architecture through the International Correspondence School and gained practical experience by working with his father. In 1904 he worked for carpenter James Martin, later his partner, in Saskatchewan. In 1906 they formed Martin and Poole Contracting. Poole continued the business under his own name after Martin retired the next year. In addition to contracting, he homesteaded and continued his studies by correspondence. The Poole Construction Company Limited was incorporated in 1913, with its headquarters first in Moose Jaw and later in Regina. The company opened an office in Edmonton in 1922, and the Pooles moved in 1932 when Edmonton became the head-office. The economy fluctuated in the early years due to World War I shortages, the post war boom, and the Great Depression, but by World War II the firm had emerged as one of Canada's foremost general contractors.

Ernest Poole travelled extensively throughout Canada on business. On trips to cities such as Winnipeg, Toronto, or Montreal, he visited friends in galleries and antique shops. The Pooles developed a valuable reference library related to their collecting interests. Their reading, combined with viewing many collections, and their friendships with knowledgeable curators and dealers led them to develop a fine collection. Their collection of Georgian silver, for example, began as a result of a friendship begun in the early 1920s with a dealer in Winnipeg

Chicken bone jade winepot and lid, with silver mounts and incised decoration, Ming Dynasty (Page 23).

who specialized in Georgian silver. Poole was impressed by the workmanship on the pieces and enjoyed learning about the characteristics of good quality silver and the identification of hallmarks.

The Pooles spent a few winters in Victoria, B.C. in the 1920s. Because of the large population of British emigrants, Victoria's antique shops were the source of many of the English pieces. The core of their collection of Chinese material was also acquired in Victoria. A shipment of Chinese works of art, said to have been collected by Bishop White, the missionary who acquired many of the Royal Ontario Museum's fine Asian artifacts, was purchased by the Pooles and Norman Mackenzie of Regina. Most of the spinach-jade pieces came from an auction sale many years later in Florida.

The Pooles were generous in sharing their love of the arts with the people of Canada. Within Alberta, in addition to their gift to the Provincial Museum, they donated to the Edmonton Art Gallery about 80 paintings and sculptures, including paintings by Tom Thompson, the Group of Seven, Emily Carr, and Jean-Paul Riopelle. They gave two marble sculptures to the University of Alberta, and they established a scholarship to the Banff School of Fine Arts. The Glenbow-Alberta Institute was also the recipient of several collections. Other beneficiaries of their generosity included: the Confederation Art Gallery in P.E.I., which received a fine collection of antique English china and a painting by R.W. Pilot; Mount Allison University in Sackville, N.B., which received two oil paintings by A.Y. Jackson; the University of Saskatchewan in Saskatoon, which received a large oil painting by F.H. Varley; and the National Gallery in Ottawa, which received a rare piece of early Canadian silver and a statue of the Virgin Mary.

THE ASIAN COLLECTION
Jade, Hardstone Carvings, and Snuff Bottles

> The model man of old compares jade to virtue; it is of warm, liquid and moist aspect, like Benevolence; it is solid, strong and firm, like Politeness; when struck it gives out a pure far-reaching sound, vibrating long but stopping abruptly, like Music; though faulty it does not hide its good points; when superior, it does not conceal its defects; like Truth, it gives out a bright rainbow; it shows a pure spirit among the hills and streams, and in the whole world there is no one that does not value it.
> [Confucius]

The Chinese have long treasured their creative artisans. Revering beauty and encouraging learning, they have carried on an art tradition of over 5,000 years of essential continuity

In jade art, as in all Chinese art, there is an underlying blend of mysticism and poetry, and the person who studies jade enters a symbolic world of myths and legends, faiths, and folklore. Jade offers us an insight into the imagery and depth of contemplative thought of an ancient and fascinating civilization.

Most people think of jade as green and white, but surprisingly it is found in almost every color of the rainbow. It is cool to the touch but warms up quickly when held, giving a pleasant earthy and sensuous sensation particularly appreciated by connoisseurs. This, along with quality of carving, are what make a piece of jade highly desirable. True

jade is quite hard and difficult to carve. A steel knife blade would fail to scratch a piece of real jade. Despite this, Chinese carvers of fine jade today continue to use techniques and tools that have changed little over the centuries.

Jade is often thought of as being restricted to two types, but should actually include three. The first, nephrite, was used since the earliest times. Polished nephrite has a somewhat oily appearance. Most archaic forms of jade carvings are created from this variety of jade. The second type of jade comes from Burma and has only been imported into China since the late eighteenth century. This type of jade was endowed with rich hues and soon surpassed nephrite in popularity, so much so that the brilliant emerald green variety became the property of the Emperor (though some question this belief). Polished jadeite possesses a vitreous, glassy lustre. The third type, formerly called chloromelanite, comprises most of the dark shades of jade. Among these three types lie the full color range.

Indicative of the symbolism attached to jade objects by the Chinese are two fine examples of *ruyi* sceptres in the collection. The first (see Page 15) is a beautiful snow-flecked white jade carved on both sides with lotus flower, water, and bird decoration. The *ruyi* sceptre is a symbol of rank given to Emperor and commoner alike on propitious occasions. It is said to be derived from the sacred fungus of life and it is considered an emblem of longevity and eternity. The lotus in the carving represents a rising up from the mud, pure and clean, just as man wishes to arise. The birds are a symbol of happiness. The second sceptre (Figure 1) is a pale shade of green (celadon) with white jade inset into the panel and plaque. It is carved with scenes of an Immortal and a deer, both symbolizing great age, and the handle is inlaid with the *ruyi* of happiness.

Carved pebbles, boulders, and "mountains" have always been dear to the Chinese. They were meant to be contemplated, perhaps on a scholar's desk, and the mottled green jade example in Figure 2 was meant for just such a purpose. It is carved with a Taoist figure of an Immortal or *Arhat* seated in a cave or grotto. The cranes, trees, and the jade itself all symbolize longevity.

Spinach-green is the color of jade most recognizable to Westerners, and there are several fine examples in the collection, including a pair of beautifully carved phoenix birds. Made for the merchant-class home, these birds were always displayed facing one another to represent conjugal affection and double happiness. The phoenix in Asia bears no resemblance to the phoenix in Western mythology. The body of the Chinese mythological figure represents the five human qualities: virtue, duty, correct behavior, humanity, and reliability. The spinach-green variety of jade is also well represented by a massive and heavily carved marriage bowl and lid, and several types of lidded vases, some with links of jade forming chains. One of the most fascinating things about these works is that they would each have been carved from a single piece of jade, further tribute to the carvers' skill and patience. In addition, there is a smaller lidded bowl carved with a dragon, the symbol of the Emperor, male vigor and fertility, and bats, symbols of good luck and happiness. Finally, there is a delicate, thin and translucent dish with a chrysanthemum-petal edge.

One of the finest jadeite pieces in the collection is a lovely grey, green, and lavender splashed vase with elaborate carving highlighted by birds, trees, and flowering branches. The carver has used the colour splashes to highlight parts of the carving. This work of art, with its plum

1. *Ruyi* sceptre

2. Mottled green jade "mountain" carved with cranes, trees, and a seated figure of an Immortal, Qing Dynasty, nineteenth century AD.

blossoms symbolizing spring, and magpie signifying good omen, was created to be simply viewed and admired.

Some of the smaller carvings in the collection are equally interesting and attractive. They are formed not only from jade, but a wide variety of other materials such as agate, chalcedony, chert, and feldspar. They are known in Chinese as *"p'a wan"* (hold and enjoy) and were made as much to fondle and wear as they were to look at. Several pendants are included, and popular themes in the carving include fruits and vegetables associated with longevity and fecundity, a concept dear to the hearts of a people whose life is dominated by ancestor worship. Others are supposed to bring good fortune or guard against evil. These objects were meant to be tucked inside sleeve ends or suspended from belts by cords or in draw-string pouches. Included in this group is a small intricate brushwasher and a water dropper that would have

adorned some scholar's desk as part of the implements used for calligraphic writing. These utilitarian objects are finely crafted works of art in their own right. The tiny brushwasher is translucent pink and delicately carved with *"ling-zhi,"* a mushroom-like fungus symbolizing longevity, rapid growth, and fertility. The water dropper is carved from pink and white agate in the form of a peach, the most common symbol associated with longevity and immortality.

One of the more interesting of the small jades is a thumb ring of white jade with emerald green splashes known as "pine branches in the snow." Thumb rings were originally worn by archers as a form of protection for their fingers, but evolved into a more decorative object, fashioned from a wide range of materials, often elaborately carved and decorated. Intended to indulge masculine tastes, thumb rings average about and inch and a half in width, one quarter of and inch in thickness, and about three ounces in weight. The favorite award of the Emperor to his generals, they were also given as gifts between friends and were worn as symbols of masculinity and sportsmanship, even though the wearer may never in his life have shot an arrow. Such jewelry was not the exclusive privilege of the male, as evidenced by the pair of finger ornaments for the Empress' fingers. These date from the late Qing Dynasty and are formed of gilt metal inset with plain and carved emerald-green jade cabochons and amber.

The Chinese have always been particularly attracted by other jade-like hardstones with striations, interesting colors, and textures. These types of stone are ideal for carving objects such as snuff bottles. Some such bottles are made out of extremely rare and valuable materials . The collection contains a number of different types of these interesting bottles. Many are extremely desirable and highly sought after by collectors.

The taking of snuff, considered medicinal, became a popular Chinese practice in the seventeenth century. It was introduced by the Manchus after the collapse of the Ming Dynasty. Later, in the nineteenth century, snuff bottle designs became far more intricate and flamboyant. Such bottles were purchased mainly by collectors as cabinet pieces. Examples in the collection include one formed from a natural white jade pebble with silver mounts, as well as a fine heart-shaped pale green amazonite bottle.

Other bottles are represented in a variety of materials, including a very unusual one of Japanese cloisonne. This particular bottle was made and signed by one of Japan's finest makers of cloisonne, Namikawa Yasuyuki, sometime between 1880 and 1900. Anyone who has a piece of his work in their collection indeed has a treasure. Yasuyuki was considered one of the best craftsman of the golden age of cloisonne production in Japan, and he was responsible for developing and refining many of the techniques used in the very best Japanese cloisonne. This is the only bottle of this type that the writer has come across in his research. It may have been a special order item for a wealthy Chinese. The delicate gold wiring and intricate enamel design deserve close attention.

The most exceptional and unusual piece of jade in the collection is the superb wine pot illustrated on page 23. It is carved from what is known as "chicken bone" jade, a rare and valuable form of nephrite that is greyish-white, opaque, and full of fine cracks. Some authorities imply that it is jade that has been through fire or long burial, resulting in a calcification and change of color. This type of jade is more fragile and brittle than normal. Evidence of this is indicated by the handle, which is

probably a replacement of the original, formed from the same type of jade as the rest of the vessel. The quality of the piece is reflected in the quality of the repair, which almost appears to be part of the original design. The new handle is attached to the wine pot with finely engraved silver mounts, copying the form of the animal mask spout. Originally there may have been wine cups to match. The form and style of the wine pot appear to indicate an earlier date of origin than some of the jades discussed in previous sections. The design is loosely based on porcelain forms developed in Yuan Dynasty (AD 1280 - 1368), a time when Persian influences were strongly felt in China.

This exceptional vessel is technically perfect, thinly carved, and translucent when held up to the light. Its subtle hexagonal, double gourd shape is exquisite, the sides finely incised with confronting mythical beasts, known as *kylins* (omens of good fortune and incarnations of the five elements out of which all things are made) amidst cloud scrolls and *leiwen* (spiral pattern) borders.The lid of the vessel is equally well-designed and crowned with a reclining, spotted deer-like creature. In all of the literature the writer has reviewed, there has been only one similarly shaped vessel dating from the early Ming Dynasty and carved from a different type of jade. Other forms of chicken bone jade that I have observed have been considerably smaller, dating from the same period, and similarly decorated. This indeed may be a one-of-a-kind creation.

Bronzes

Chinese archaic bronzes are considered by some to be the finest and most spectacular art objects produced in any part of the ancient world during the Bronze Age. In Asia the Bronze Age began about 2500 BC and ended in the middle of the Han Dynasty, 206 BC - AD 220. It was during this time that outstanding craftsmanship and Chinese spiritual tradition became intimately connected. Vessels were used for sacrifices to the gods and ancestors and often buried in tombs with the dead. The alkaline soil of China, favorable to bronze, turns it to an attractive blue-green malachite color, a pleasant patina considered highly desirable by knowledgeable collectors.

Bronze vessels have always fascinated the Chinese. So much so that the first catalogue of these vessels was published in China in the eleventh century AD. In the following century, the Emperor Hui-tsung had his scholars catalogue his collection of over 800 bronzes. In succeeding centuries, these illustrations were used to make copies of early examples. The use of drawings as a basis for design resulted in subtle differences in scale and decorative motifs on these copies, important clues to dating. Archaic forms were also copied in jade, ivory, lacquer, and porcelain—further proof of the reverence held by the Chinese for ancient bronze vessels.

The first Western book on ancient bronzes was published in AD 1851, but archaic vessels were not seriously collected or studied in the West until the twentieth century. Since the 1930s scholarship has grown, and our appreciation of Chinese artistic culture has developed. Yet, much is still shrouded in mystery, and we know little about how these ritual vessels were used. We do know that early bronzes are related to traditional funerary rites and that there was rigorous adherence to ceremonial protocol. The deceased were given all they needed for the afterlife. Many of these sumptuous vessels were cast to accompany them. In order to receive the proper wisdom and advice from deceased

3. Archaic bronze *Ku* beaker with incised decoration and green malachite encrustations, Shang Dynasty, twelfth to thirteenth century, BC.

ancestors, the right offerings had to be made and the appropriate sacrifices (including human) performed. Only the priests and kings could afford such luxury items, and only they could interpret the advice offered by the ancestors. The importance of bronze vessels is revealed by some of the inscriptions found on them. "To be used and treasured forever" is an inscription translated from numerous examples of early ritual bronzes.

Most types of archaic bronzes originated in the Shang Dynasty (1766 - 1122 BC), and based on our limited knowledge of their use, there are four basic types, including vessels for the preparation of sacrificial food, vessels for storing sacrificial food, vessels for heating sacrificial

4. Large bronze winepot with dark patina, the exterior decorated with figures of men and beasts, possible Late Zhou or early Han Dynasty, third to fourth century BC.

wine, and vessels for libation and storing sacrificial wine. The Ernest E. and Gertrude Poole Collection has examples of each.

Early Shang vessels had smooth and elegant forms, with limited decoration, and flanges when present are minimal. Illustrated in Figure 3 is an excellent example of an archaic *Ku* wine vessel (one of two in the collection), finely patinated with the malachite encrustation and color mentioned earlier. The ornamentation, seen in detail, represents the bodies of real and mythological animals in two-dimensional pattern. The artists took elements of the design, separated, distorted, fragmented, and recombined them into new motifs, more or less abstract, and then adapted them to prescribed areas such as panels and bands on the sides of the vessel. The effect is to create flat or low relief masks with fierce components such as horns, fangs, and claws seen both full face and confronting each other. This is the dominant motif of archaic bronzes and is called the *t'ao t'ieh* mask. It can appear in both feline and bovine forms, but its original meaning is lost. Another motif in the *Ku* beaker illustrated is early evidence of the thunder or *liewen* pattern, a pattern of spirals representing the heavens and a design element found in Asian art throughout history.

As time passed, the decoration became more lavish. The entire surface came to be covered, the elements becoming multiplied and elaborated almost beyond recognition. The *t'ao t'ieh* mask formed ever more distorted images of fantastic beasts, endowed with the magical powers of the supernatural. As well, recognizable birds and animals began to appear. Decoration became progressively higher in relief and

vessels became impressively lavish. By the middle of the Zhou Dynasty (1122 - 249 BC) the influence from the intrusion into China of nomadic hunting cultures could be seen. In the collection, but not illustrated, is a fine Bronze *Huo* winepot with a bird-shaped spout and animal handle. Further evidence of the hunter style is shown by the large winepot illustrated in Figure 4. Dating possibly from the Late Zhou or early Han (206 BC - AD 220) Dynasty, the importance of the animal to the Chinese is presented, and the belief in the world and man rising from chaos and the primordial mud is indicated by the dragon-like salamanders emerging from the sides of the vessel. Up until this point in time, images of man had played only a minor role. Here he is shown in a superior role, having risen above mere beasts.

The bell in Chinese legend represents the extremes of both good and evil. Its symbolic meaning is celestial: the vault of heaven. The sound of the sacred bell is believed to disperse evil spirits. That is why smaller versions are hung on the eaves of temples, to be sounded by the wind. There are three bronze bells in the collection, with one dating from the Zhou Dynasty. A second, almost identical one is a later copy, while the third and largest is of uncertain date. The only decoration on this unusual cylindrical bell is a figure of a lion, symbolizing power and

5. Bronze Buddha, Qing Dynasty, eighteenth or nineteenth century AD.

6. Silver and bronze mirror, Han Dynasty.

strength, attached to the top.

As the Bronze Age came to a close in the Han Dynasty, ritual vessels no longer played an important role. More utilitarian uses of bronze emerged, and new types of vessels were produced as evidenced by the group of period garlic-headed vases in the collection. Other pieces were cast for personal adornment, and the collection features a fine jade-inlaid belt hook in the shape of an elongated animal head. Bronze mirrors were made for personal adornment and were cast with a cord loop on the back so they could be worn suspended from a sash around the waist. The mirror illustrated in Figure 6 is a typical example, the back decorated with celestial creatures and a grapevine motif. This motif is a result of Iranian influences and hints at the mystical union with heaven and life after death. Mirrors often express archaic decoration, providing helpful aids to symbolic interpretation.

It was in the middle of the Han Dynasty, at the end of the first century AD, when Buddhism reached China. The introduction of Buddhism brought about the demise of ritual vessels in their ancient forms, and the skill of the archaic bronze caster disappeared. Instead, bronze became important in the production of Buddhistic images in a broad range of styles and poses. A number of these figures are in the collection, including the large and impressive Buddha with lovely brown patination shown in Figure 5. Dating to the early Qing Dynasty (seventeenth to eighteenth century) the Buddha is shown in seated meditation. His hand, touching the earth, the long ears, and wheel marks on the feet are all Buddhist emblems.

One of the most striking bronzes in the collection is the imposing censer presented in Figure 7. This finely patinated figure, cast in the form of a *Fo* dog, is the Chinese version of a lion, likely dating from the seventeenth or eighteenth century AD, and originally one of a pair. This example is the male, paw placed on the *Jewel of Law*, and would have sat to the right. The number of bumps on the lions heads indicate the rank of the official's home they were guarding. What an impressive sight they must have been as the fragrant incense and grasses burned inside, smoke issuing forth from the mouth, ears, and nostrils! What spirit would dare to enter unwelcome?

Swords, Sword Fittings, and Metalwork

Japanese metalwork is unrivaled in artistry and craftsmanship, a testimony to the skill and ingenuity of the tens of thousands of metal artists working in Japan during the last millennium. It is an aesthetic tradition among these craftsmen to endow with beauty objects of practical use. Nowhere is this better illustrated than in Japanese swords and sword hardware.

The art of the Japanese sword and its fittings is complicated and technical. There are hundreds of terms for the various types of blades, mounts, and associated hardware. For the collector, it is a demanding field requiring specialized knowledge of materials, techniques, and provenance.

Beginning in AD 800 with the first sword of recorded date, there have been many thousands of swordsmiths who have dedicated their lives just to the production of the blade. Their sword blades are considered to be the finest ever produced. When the sword was several hundred years old, various schools began to concentrate on the production of decorative fittings (sword furniture). This development coincided with the rise of a unique and superior military caste, the

samurai, whose business was to do battle and serve their feudal lords. They glorified the sword and its elaborately decorated furnishings.The blade was the soul of the *samurai*, often passed down from generation to generation, treated with respect and revered for its quality. Sword fittings, on the other hand, were replaced when they were worn and changed for special occasions. Sometimes, during hard times, they were sold.

In their work, the metal craftsmen created scenes from all aspects of daily life, as well as popular characters from Japanese mythology and from nature. It was this deep love of nature, wrapped in symbolic meaning, that inspired the crafting of works far more significant than mere reproduction. The wide variety of metal techniques allowed the craftsman to achieve strong, decorative pictorial compositions with

7. Impressive large bronze censer in the form of a *Fo* dog, Qing Dynasty, nineteenth century AD.

incredible depth. He painted in metal.

Most of the acclaimed metal artists came from families that had worked for generations on armor and swords. Iron was the earliest metal worked in Japan and is highly esteemed. It formed the basis for the high development of Japanese metal craft. The steel blades that were produced by the best makers are a marvel, sometimes taking as long as a year to forge and temper. When it came to the production of the fittings, iron could be used in a variety of ways and could be colored in shades from grey to russet, or satin-like bluish grey to deep rich black. The craftsman's skill with iron is illustrated by a number of sword guards (*tsubas*) in the collection. *Tsubas* were designed to fit between the blade and the hilt, protecting the hand. The centre slot was designed to accommodate the blade. Sometimes there were slots on one or both sides of this opening designed to accommodate a smaller evil-looking dagger and an equally unpleasant- looking skewer. Early *tsubas* were made of iron and strictly functional. As the skill of the craftsman improved, the decoration of iron became more involved, with elaborate pierced designs, inlays, and finishes.

8. *Sentoku* bronze *tsuba*, carved in relief with a copper figure of a fox, the reverse with incised decoration, signed, probably nineteenth century AD.

By the Meiji era (AD 1868-1912) more than thirty alloys were in use, allowing the craftsman to shade bronze and other metals to almost any color. Gold and silver were in short supply in Japan. Craftsmen used less valuable metals to produce works of art. Copper was used extensively, producing, besides its normal reddish brown color, shades from a deep coral to lobster red, green to dark grey and black, yellow to dark brown, and a host of intermediate colors. The signed, square-shaped *tsuba* in Figure 8 is a fine example of the use of copper. The body is a special alloy of bronze called *sentoku*, extensively used and greatly admired for its soft golden brown color. The main feature of the decoration is a copper figure of a fox (represented as a mischievous trickster in Japanese folklore), cast separately, inlaid, and carved. The eyes are gold inlay and the teeth are formed from dark metal. The rest of the decoration on the front and the reverse is called *katakiri-bori*, an incised carving technique that requires intense concentration and finesse. Each component of the carved decoration is the result of a single controlled stroke of the artists chisel; there is no room for mistakes with this technique.

9. Iron and copper *tsuba*, with carved and inlaid gold decoration in the form of a basket and peonies, on a pebbled *nanako* ground, probably nineteenth century AD.

Numerous techniques of inlay and carving colored metals were part of the metal worker's repertoire. The iron and copper *tsuba* in Figure 9 illustrates the technique of *takazogan*: inlay carved in high relief. The design of peonies in a basket, symbolizing beauty, youth, freshness, and spring, has been inset in finely carved gold over a fish-roe type ground known as *nanako*. This effect is created using a punch and carefully controlled strokes with a hammer to create an even and perfectly aligned pebbled surface, each bump individually formed and identical to its neighbor. This effect was greatly admired by the Japanese, requiring consumate skill.

Other sword guards in the collection demonstrate the fine art of *iro-e takazogan*. This technique involves the inlay of *shakudo* (a black alloy of gold and silver), *shibuichi* (a misty grey alloy of gold and silver), copper, gold, silver, and other materials in high relief. The craftsman then carves the inlay, incorporating the colors of the various metals into the design. Today in Japan there is only one metal artist still practising the time-consuming and obscure technique of *iro-e takazogan*.

When creating tsubas and other sword fittings, the artist will often resort to only a few chosen elements, naturalistic to abstract, with or without symbolism. More important is elegance of proportion,

intelligent filling of the surface, and rich colors and patina. Because the sword is worn angled across the waist, it is necessary for the artist to place the main components of the *tsuba's* design in a position where it can be viewed and admired.

In AD 1868, the arrival of the Meiji period heralded the end of the *samurai* as a distinct class. The metal worker was forced to turn his skills in new directions. At this time, the Japanese metal craftsman was unrivaled. Techniques such as the hammering of metal were so refined that a skilled worker could hammer to perfection an elaborate long-necked vase from a single paper-thin sheet of copper or iron. The metal worker's ability to make alloys, patinate, and create inlays was unsurpassed.

THE EUROPEAN COLLECTION

Silver and Gold

Silver has long been a medium for decorative works of art, but in the Western world the collecting of silver did not become fashionable until the nineteenth and twentieth centuries. It was not until this period that the artistic and historical importance of silver was realized. Silverwares tell us much about the periods in which they were made: information about architectural styes, public tastes, fashionable trends, and economics. The Ernest E. and Gertrude Poole Collection of silver at the Provincial Museum of Alberta offers many fine examples dating from the mid seventeenth century to the early twentieth century. These include English, Continental, and Canadian flatware and tableware; Russian silver; European snuff boxes in silver as well as gold; fine plate by Hester Bateman and Paul Storr; and an excellent selection of early French Canadian church silver.

The collection boasts numerous examples of early English silver by a variety of silversmiths, but two are particularly noteworthy. Hester Bateman (fl. 1761-1793) was a member of a London silversmithing family, and, as one of the very few female silversmiths, she has attracted a great deal of attention from collectors. She produced large quantities of fine household platė, particularly in the 1780s, and her works reflect the styles of the Adam Period of the late eighteenth century. At this time, relief decoration on silver became less important, with the form generally restrained, reflecting classical architectural styles. Quite a number of Bateman's works can be found in the collection including flatware, tea caddies, sugar baskets, and a very fine teapot with stand dating from AD 1789 and AD 1787 respectively. The teapot is typical of her works at that time. It is oval-shaped with beaded trim, straight spout, and ebony handle and knop. The decoration has been kept to a minimum, the form classical.

Of particular note are some of the works by Paul Storr (AD 1771 - 1844). Considered one of the leading Regency Period silversmiths in England, Storr's work reflects more heroic proportions, a reassertion of the classical ideals, based on a better understanding of architecture and the revival of early Egyptian forms. Storr was responsible for a large output of utilitarian and decorative plate but was best known for his monumental style, making his name mostly in the field of presentation silver, creating works for the Prince Regent and the Royal Family. During the Napoleonic Wars, his works were in demand as gifts for victorious generals and admirals. The presentation sculpture in Figure 10 is typical. This classically clad figure of Britannia with gilt lion and laurel wreath dates from December 1811, and was presented by the

people of the Isle of Guernsey to Vice Admiral Hubergne, Prince of Bouillon, for his protection of their trade and interests. This particular piece was advertised in the Antique Dealer and Collectors' Guide by Mitchell-Hedges Antiques in London and was purchased from them by the Pooles. Other works by Paul Storr in the collection include an urn-shaped vase with mask handles dating from AD 1829 and a sugar bowl dating from AD 1836.

In the sixteenth century the taking of snuff was all the rage amongst the fashionable in Europe. It quickly became part of daily life, with the man-in-the-street carrying snuff containers of horn, copper, tortoise shell, and other inexpensive materials, while the rich were content with nothing less than gem-encrusted gold, silver, ivory, or something equally exotic. The snuff box became a splendid object of male jewelry, and every device in the goldsmith's and silversmith's repertoire was employed in its adornment. Many boxes were extremely costly and extravagant, rivaling the finest creations of the best jewelers. By the eighteenth century it had become the practice for monarchs to present snuff boxes to dignitaries and generals as a mark of honor. The collection includes several of these. One exquisite example (See Page v), dating from AD 1860, is a fourteen karat gold continental snuff box with blue enamel trim and carved design overall. In the centre of the lid appears an oval ivory portrait of Friedrich August, ruler of Saxony. The box was presented by Kaiser Franz Joseph of Austria to the adjutant

10. Silver presentation sculpture by Paul Storr, dated AD 1811.

Duke Paar of Bohemia. The portrait is purported to have been painted by the royal artist and is surrounded by over five carats of diamonds. In the collection there is another gold snuff box of similar design and date and a variety of examples of silver snuff boxes from England, Ireland, and Europe.

It was during the nineteenth century that Russian craftsmen produced some of their finest works in silver and gold. Several items in the collection reflect their superlative skill, including a very heavy octagonal teapot (Figure 11) and matching coffee pot, both dating from AD 1879. They are elaborately decorated, with curved spout in the form of a rooster's head, and a pedestal base.

Other Russian works of art from The Ernest E. and Gertrude Poole Collection include several very fine silver cigarette cases. The one in Figure 12 is beautifully crafted, with fluted surface in a sunburst pattern and a gilt Imperial eagle in one corner adorned with a Russian sapphire press-button opener. This attractive case was crafted in St. Petersburg in the late nineteenth century and appears to be a creation of

G. P. Grachev, a court appointed silversmith. It is just one of several fine Russian cases in the collection.

Any discussion of Russian silversmiths would not be complete without mentioning the Fabergé firm. Founded in AD 1842, it reached its zenith under Peter Carl Fabergé between AD 1870 and the first World War. During that time it became the most fashionable house in Europe, achieving a high level of craftsmanship. Fabergé produced jewelry and useful objects for the rich and powerful: cigarette cases, snuff boxes, bell-pushes, and other similar items. This collection has two examples of the works of Fabergé. Both are table bells. The first is made of onyx in the shape of a small barrel with gilt metal mounts and feet. It has a Russian sapphire push-button mechanism and Fabergé factory mark. The second bell is crafted in Art Nouveau style in the form of a stylized butterfly. It is formed from pink enamel with silver mounts and three garnet push-buttons, and it is engraved with the date, May 17th, 1910, along with a script mark and Fabergé factory mark. Both bells are excellent examples of quality works from Czarist Russia.

11. Russian silver teapot with elaborate decoration, dated AD 1879.

The fashioning of silver in Canada had a significant place in the field of decorative arts, both during and after the colonial period. The silversmith was closely identified with the social and economic life of the community and was a citizen of importance. Quebec was the home of the earliest silversmiths in Canada. They were first mentioned in records as far back as AD 1667, a time when there were fewer than 16,000 inhabitants of European origin in the country. The majority of these early works from Quebec were made for ecclesiastical purposes. Church silver represents the most important early Canadian silver. In addition, because of preservation, silver from Canada tells us more about French styles than the silver that can be found in France itself. This is because a large portion of the silver made in France was melted down to pay for successive wars. Early Quebec silver, copied from church silver brought from France, is representative of the styles of Louis XIV, Louis XV, and Louis XVI.

A number of the ecclesiastical works in the The Ernest E. and Gertrude Poole Collection have counterparts in other major collections,

12. Russian silver cigarette case, fluted surface with gilt silver Imperial eagle and sapphire, late nineteenth century AD.

including the Henry Birks Collection, and represent some of the best work by the most important Quebec silversmiths. A small cup by Paul Lambert (AD 1691-1749), a very prolific craftsman working in Quebec City, is the oldest piece of Canadian silver in the collection. As well, there are works by Pierre Huguet (AD 1749-1817) and his son Pierre Huguet dit Latour (AD 1771-1829), master silversmiths who worked in Montrèal. These two artisans are well represented in the collection, and examples of their work include ciboriums, benetiers, censers, navettes, and processional crosses.

Other artisans are equally well represented in the collection. The finely crafted silver chalice with gilt interior, illustrated on Page 12, is only one example of a work by Quebec City silversmith, Francois Ranvoyse (AD 1739 - 1819). He was considered one of the most outstanding makers of church silver working in the province of Quebec at the end of the eighteenth century. Ranvoyse's works, and the works of numerous other silversmiths such as Soloman Marion, Jonas Schindler, Francois Sasseville, and Charles Adam, serve to illustrate the quality and historical significance of the silver in this collection.

Ernest and Gertrude Poole were collectors of tremendous scope. The works of art we have described constitute a small portion of the total collection. Collections such as The Ernest E. and Gertrude Poole Collection bring some of the finest objects that "earth and hand have made" into the Provincial Museum of Alberta. These collections broaden our understanding of human culture and give us an opportunity to enjoy the work of some of the world's fine craftsmen and artists.

TREASURES
in Metal and Money

The Carl Nickle Collection

TREASURES IN METAL AND MONEY

The Carl Nickle Collection

Robert S. Kidd

The story of money is closely bound to the history of mineral discovery and exploitation. As human societies became large and complex, long-standing systems of barter were gradually supplemented or replaced by fixed units of value. Initially, these units might be stone axes or knives or marine shells, but later objects of metal were generally used.

Coins

The evolution of metal coinage followed several parallel courses. In China small replicas of functional axes, hoes, and knives were used as money at least by the sixth century BC The knife forms may have evolved directly into the "cash" coins circulated until recently.

A more familiar coinage seems to have developed in Asia Minor during the seventh century BC. In Lydia, small lumps of "electrum," a natural alloy of gold and silver, were stamped with the head of a lion as a symbol of the ruler and a guarantee of weight and fineness.

By the late sixth century BC, coinage had become similar to modern forms. Aegina drachmas, stamped with the images of sea turtles, were the first major European coins. Athenian tetradrachms displayed the well-known portrait of the goddess Athena. From this time, the Athenians made extensive use of silver from the Laurion mines near Athens itself.

In the late fifth century BC, about the time of Herodotus and Socrates, coinage in Greece and its colonies had reached an artistic apex. Magnificent coins of Syracuse display the nymph Arethusa, struck in deep relief and sometimes surrounded by swimming dolphins.

The Late Middle Ages

From the time of its origins in the Orient and Asia Minor, then, coinage is more than 2,500 years old. However, the coins in the exhibit ***Treasures, What Earth and Hand Have Made,*** date within approximately the past 700 years. This period is well represented in the Carl O. Nickle Collection.

The late Middle Ages had inherited rich technologies for coining silver and gold. For example, the Byzantine solidus or nomisma, struck without much change between the fourth and eleventh centuries, had

Four thalers of Christian Ludwig, Brunswick-Luneburg. German states, 1664, showing the workings of a mine. (Page 41)

1. English gold noble of Edward III, ca 1344.

2. Silver "Joachimsthaler," ca 1520.

become a major gold coin. In the eighth century AD, Pepin the Short and his successor Charlemagne had introduced the silver denarius or denier in France, and shortly afterwards, Offa, King of Mercia in England, had issued a silver penny. Similar English pennies persisted over hundreds of years, through Saxon, Danish, and Norman occupations.

Mining in Europe was well developed by 2,000 BC, when the still-viable Rio Tinto Mine in Spain was already producing. By the mid tenth century AD, the Rammelsberg silver deposits had been discovered in the Harz Mountains of Germany. Here, during the fourteenth century, intensive mining took place. In the same century, and in what is now Hungary, the Kremnitz Mint opened.

In England, about the time of the Hundred Years War and the great Plague, the magnificent noble of 1344 established a functioning English gold currency (Figure 1). With this noble, also, begins the fine series of British coins collected by Carl Nickle.

The Renaissance: Metals and Coins of the Old and New Worlds

In 1453, Constantinople fell, ending the Byzantine Empire and shifting numismatic focus to the Hapsburg Holy Roman Empire of Renaissance Europe. As in previous centuries, Europeans continued to develop new metal deposits, notably in eastern Germany.

In addition, colonial metal deposits were increasingly exploited. At the same time, the improvement of mining, refining, and manufacturing technologies permitted the better use of domestic resources.

For about two thousand years, coins had been made by placing a metal blank between upper and lower dies and striking the upper one

with a hammer. As early as the fifteenth century, however, the first coining machine had reportedly been designed by the Italian architect Bramante. A short time later, Leonardo da Vinci devised an improved press and rolling mill. By 1555, a water-driven mill was operating in the French Mint in Paris, and at about the same time, an experimental model was tried in London. Experiments continued, but it would be more than 100 years before machines would be in full use for coin production in Great Britain.

In the mid to late fifteenth century, European mines were rejuventated by new technology and discovery. An abundance of silver coincided with a growing competition between rulers of the Holy Roman Empire, and notably the German states, and with a flowering of the medallic arts. In approximately 1486, the first "dollar-sized" silver coins were produced, the guldiners of Archduke Sigismund of the Hapsburg Tyrol (Austria). About 35 years later, similar coins struck in the Valley of Saint Joachim, Bohemia (now Czechoslovakia), were called "Joachimsthalers" (Figure 2), the origin of our word "dollars."

A flood of "thalers" and multiple "thalers" followed. These large silver coins were difficult to strike by the hand-hammering method, and their proliferation no doubt encouraged mechanization of the mints. Silver thalers, daalders, crowns, and dollars are emphasized in the collection of Carl Nickle.

In 1502, during his fourth voyage, Christopher Columbus found evidence of gold in Central America. However, it was not until after the Conquest of Mexico in 1521 that New World riches became a significant factor in the history of European coinage. Exploitation was rapid. Silver was discovered in Tasco, Mexico, in 1524. By 1534, the Tasco deposits were being worked, and in 1535 a mint was opened in Mexico City and the first silver reals were struck. Mints also opened in Peru and Columbia in South America.

New World sources of silver came into production as some of the European mines were faltering. Redistribution of metals within Europe and into non-European countries was also becoming a significant factor. By mid-century, imported coins, particularly Spanish-American silver "dollars," were becoming accepted currency in many parts of the world.

Silver was discovered at Potosi, Bolivia, in 1545, and in 1554 a new method of processing the ore with mercury was developed in Mexico. The emphasis in both discovery and technology was shifting from the Old World to the New. Mints were established in Lima in 1565 and Potosi in 1572. Around 1616, the first English coins were produced specifically for use in the New World: the "Sommer Islands" or Bermuda "hoggies."

Towards a Modern Coinage - the Machine

In England, the first large silver coins or "crowns" were struck in 1551, during the reign of Edward VI (Figure 3). Large gold coins also continued in the form of the "sovereign," struck for example during the reign of Queen Mary (Figure 4).

In 1642 the Tower Mint was formally established in London, and the first English pound was struck. Despite earlier attempts at mechanization of this mint, it was not until 1662, after the Revolution and subsequent Restoration of Charles II, that full use of machines was achieved. Power for the rolling mills was supplied by four horses and for the screw coining presses by two to four men.

At nearly the same time, in 1663, colonial influence again emerged

3. English silver crown of Edward VI, 1551.

4. English gold fine sovereign of 30 shillings, Queen Mary, 1553.

5. Gold two guineas of Charles II, 1664.

6. British "Vigo" silver crown of Queen Anne, 1703.

7. Mexican "pillar" silver dollar of Ferdinand VI, 1751.

8. United States "flowing hair" silver dollar, 1795.

strongly with the striking of the first British gold guineas. On a number of these guinea issues, a small raised elephant stamp, sometimes with "castle," indicated the African origin of the metal (Figure 5).

More than 100 years after the destruction of the Spanish Armada, British ventures at sea continued. In 1703, for example, during the reign of Queen Anne, English crowns bore the legend "Vigo," commemorating the capture of Spanish treasure at Vigo Bay, Spain (Figure 6). Similarly, the 1746 "Lima" crowns of George II were made from coinage and bullion captured near Peru.

Silver discovery and exploitation persisted in the New World. In 1732, one of the most important trade coins in history appeared: the Spanish "pillar" dollar, struck until 1772, often at the Mexico City Mint (Figure 7). This dollar and its successors formed the early coinage of the United States and Canada, and it was used in many other parts of the world.

Steam Power

In the United States, numerous private, colonial, and state-issue coins or tokens had appeared over approximately 150 years. In 1792, however, the United States mint opened, initially striking about 1,500 half-dimes, reportedly made from George Washington's table silver! The first true "business" strikes, however, were made in 1793; the first silver dollars appeared in 1794 (Figure 8); and the first gold coins in 1795.

By the end of the eighteenth century, American decimal coinage was flourishing, but British coinage had declined. As a temporary measure, the Bank of England issued Spanish silver eight reals counterstamped with the head of George III. These provisional coins led to extensive forging and much ridicule.

For a lasting solution, the government turned to Matthew Boulton and his "Soho" Birmingham mint. Boulton had collaborated with James Watt, initially in such endeavors as supplying steam engines to the Cornish tin mines and later in the application of steam power to the coining process. Boulton set about replacing Spanish silver dollars and renewing the English copper coinage, producing the immense penny and two-pence "cartwheels" of 1797.

The Nineteenth Century

The early nineteenth century brought major changes in both the Old and New Worlds. Napoleon became Emperor. Lewis and Clark made the journey that opened up the western United States. In China, there was an increasing influx of western coins, many of which were "chop-marked" or counterstamped to attest value. In Spanish America, the insurgent movements began, resulting in the issue of emergency coins by rebels such as Morelos in Mexico.

British artistry in coin design developed under such masters as the controversial Pistrucci, originator of the "George and the Dragon" image for the coins of George III, and the Wyon family, pre-eminent designers for Queen Victoria. The Wyon skill was illustrated in such masterpieces as the "Una and the Lion" five pound proof of 1839 (Figure 9). British designers such as the Wyons also served the growing colonial market, notably Canada, producing tokens and medals as well as regal coin issues.

In Russia, the first silver roubles had appeared under Peter the Great in 1704. Between 1828 and 1845, Russia issued platinum multiple

roubles, the first and essentially the only significant use of this metal in circulating coinage.

The Gold Rushes in America

The first major gold rushes in the United States began in the Appalachian region about 1828, followed eventually by the establishment of branch mints in Georgia and North Carolina. A few years later, in 1835, placer gold was also discovered near Quebec City in Canada.

In 1848-1849, the California Gold Rush began, initially resulting in a number of private or state-issued coins, including the semi-official Moffat-Humbert fifty dollar gold piece of 1851-1852 (Figure 10) and various fractional gold tokens. Increasing gold supplies were also accompanied by the issue of two new official denominations: the one dollar and the twenty dollars or "double eagle."

In 1854, largely as a consequence of the California gold rush, a branch of the United States Mint was established in San Franciso.

In the late 1850s, gold was discovered on the Fraser River of British Columbia and, in 1860, in the Cariboo near Barkerville, British Columbia. In 1858, the first coins for the "Province of Canada" were struck in London.

In 1862, a mint was set up in New Westminster, B.C., striking ten and twenty dollar gold "patterns" before being closed.

9. British "Una and the Lion" 5 pound gold proof, Queen Victoria, 1839.

10. California Moffat-Humbert 50 dollar gold piece, 1851.

11. United States "double eagle," 20 dollar gold piece, high relief, 1907.

12. Chinese "automobile" silver dollar, 1928.

The Civil War and After

The Civil War had a considerable impact on the monetary system of the United States, for example promoting the use of paper currency and inspiring the motto on coins: "In God We Trust." A revitalized Liberty reappeared on the United States "Morgan" dollars of 1878. Morgan had been a student of the Wyons in Great Britain, and he carried forward the strong classical tradition of coin imagery. Such imagery persisted, notably in the 1907 twenty dollars design of Augustus Saint-Gaudens (Figure 11).

Silver dollars continued to be important in various parts of the world. In China, for example, a modern mint was established at Canton in 1889, and soon began to strike western-style dollars with a "dragon" image. A few years later, in 1895, Britain re-introduced a trade dollar, which continued in production until 1935.

To the North

In the late years of the nineteenth century, the "gold rush" was again on the move. In 1887, the first gold dredge appeared on the North Saskatchewan River in Alberta. By 1898, there were twelve dredges working at Edmonton, but in 1907 they were gone. In 1890, the Rossland gold camp was established in British Columbia. A few years into the following century, major gold discoveries would be made in Ontario and Quebec.

In 1898, however, the focus turned to the Klondike of Alaska and the Yukon Territory, and to the last major gold rush in North America. Unlike its predecessors, however, the Klondike rush seems to have had relatively little impact on coinage.

The Twentieth Century

In the early twentieth century, relatively "new" metals such as aluminum, or new alloys or other combinations of old metals, were appearing frequently in coins and medals. In 1908, the mint was established in Canada, and for the first time official Canadian coins were struck within this country. Among the denominations produced that year were the first Canadian gold coins, specimens of "C" mint-marked sovereigns.

In China, the 1911 Revolution had established an increasingly westernized currency, including the beautiful "pavilion" dollar of 1921 and the Kweichow "automobile" dollar of 1928 (Figure 12), supposedly one of two known coins showing a motor car.

In 1933, an act was passed prohibiting United States citizens from possessing gold, essentially the end of a circulating gold coinage in that country. In the same year, gold was discovered near Yellowknife in the Canadian Northwest Territories.

Coinage, however, was progressively making more use of metals other than gold, silver, and copper. During the Second World War in particular, a number of substitutes were employed, including such unlikely materials as zinc and steel. In Canada, the 1942-1943 nickel was made of "tombac," an alloy of 88% copper and 12% zinc, and the 1944-1945 nickel was made from nickel-and-chrome-plated steel.

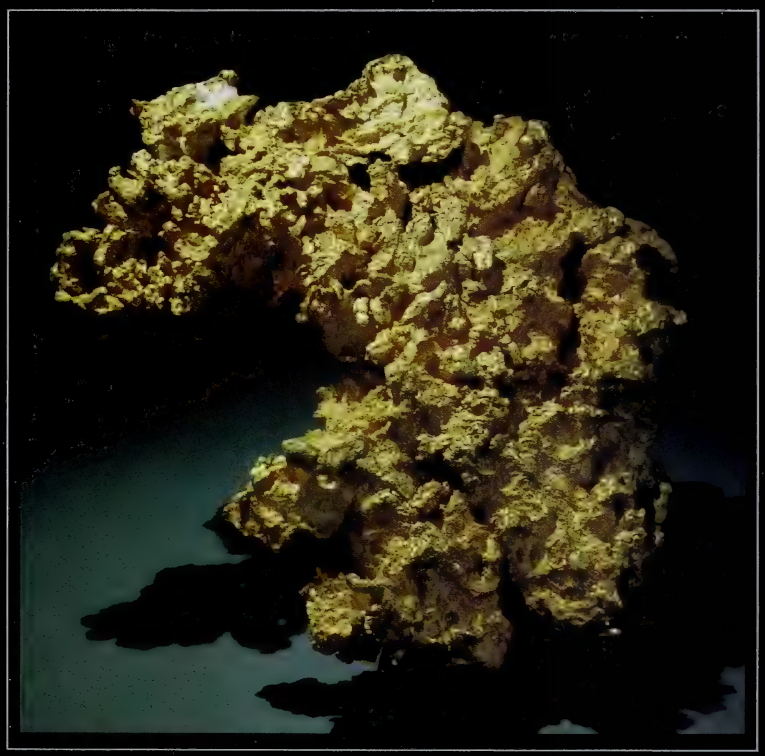
Nickel was in fact becoming the metal of choice for a number of world coinages, although often it was alloyed with copper. Beginning in 1958, nickel or copper-alloy "trade dollars," usually issued by communities for limited-time exchange, became a form that is still popular in Canada. The Sherritt Mint in Fort Saskatchewan, Alberta,

established in 1966, has struck a large number of these trade dollars.

In 1967, Canadian silver coins were struck to commemorate the Centennial. The following year, some 50% silver coins were issued, and thereafter silver was replaced with nickel. Also in 1967, South Africa issued the first krugerrand bullion coins, sold for their metal value.

Both of these recent issues are included in the Nickle Collection. Together with such pieces as the fourteenth century gold noble, they reflect the wide range of Carl Nickle's coin-collecting interests.

TREASURES
in Minerals and Metals



The Geology Collection

TREASURES IN MINERALS AND METALS

The Geology Collection

Ron Mussieux

The geology collection at the Provincial Museum of Alberta was started in 1967 and has been growing rapidly since then. At present, the collection contains more than 15,000 rock and mineral samples. The geology collection has three major components; the Alberta rock and mineral collection, the Historical and Archival collection, and the Interpretive collection. All three are built through field work, purchase, donation, and specimen exchange.

Undoubtedly every specimen in the collection has its own story. How did the specimen survive natural or man-made trauma until it was acquired by the Museum? How was the specimen first discovered and collected? What historical or scientific significance does it have?

Alberta Rock and Mineral Collection

The Museum is acquiring a representative collection of rare as well as common Alberta rock and mineral types. It is this material of local origin that allows us to interpret the geological history of our province. Over the past 20 years, these specimens have been collected through regular field work over the province and have been supplemented by a number of significant donations from individuals, private companies, and government departments.

A good portion of this collection is related to Alberta's mineral wealth. We have obtained samples of oil sands, "synthetic crude oil," and sulphur from Fort McMurray, as well as drill cores of rock salt from the older, underlying formations. The collection contains coal samples from mines on the plains and in the mountains, as well as a significant collection of crude oil samples from the early days of oil production in Alberta. Included in the collection are samples from several Alberta metallic mineral prospects, such as the copper deposits of the Castle River area, the iron-titanium deposits of the Crowsnest Pass, the lead-zinc deposit of the upper Oldman River valley, and the iron deposits of the Clear Hills. None of these prospects has yet been developed into a mine, but the specimens represent a valuable reference and interpretive collection.

Alberta's oldest metallic mineral industry is placer gold mining, which began in the Edmonton area in 1860. In 1898 Edmonton became a supply centre for the overland route to the Klondike gold fields. It is less

1. Rare cubanite crystals from the Henderson No. 2 mine, Chibougamau, Quebec. These flattened crystals are actually made up of intergrowths of two, four, or six individual crystals and are termed "twins." Cubanites from this closed mine are probably the world's finest.

2. The Iron Creek meteorite or "Manitou stone."

well known that between 1896 and 1907 there were as many as twelve gold dredges working the gravel bars within Edmonton's present-day city limits. Today gold panning remains as a weekend hobby, and often several modern-day prospectors can be seen at work along the river.

The public has provided the Museum with a number of fascinating geology samples. My personal favorite is a fine fulgurite specimen from Peace River. A fulgurite is sand or soil that has been fused into glass by the heat from a lightning strike. In this case, lightning had struck a radio station transmitting tower, travelled down a guy wire into the ground, and fused the soil into a tapering tube about 36 cm long. The outside of the tube has retained the dull grey blocky appearance of soil, but the inside of the specimen has melted to a lustrous, frothy glass, still containing a fragment of copper guy wire.

Undoubtedly, the Alberta specimen that receives the most public interest is the Iron Creek meteorite or "Manitou stone" as it is often called (Figure 2). The Iron Creek meteorite was venerated by both the Cree and the Blackfoot peoples. In the 1860s it was removed from an unidentified hilltop above Iron Creek, near the modern town of Killam, by the Reverend George McDougall. The meteorite was shipped for scientific study to Victoria University, now a part of the University of Toronto. According to the belief of some native peoples, outbreaks of

disease, warfare, and the demise of the bison were all a direct result of the removal of this meteorite.

The Iron Creek meteorite was returned to Alberta in 1973 and has been on display in the Museum's Geology gallery since that time. One of the finest iron meteorites found in Canada, it weighs 320 lbs (145 kgs.) and is roughly conical in shape. Only the face of the cone shows the pitted surface that is a result of excessive heating from friction as the meteorite moved through the atmosphere at very high velocity.

3. Day crew of miners posed in front of the entrance to the Bralorne gold mine, October, 1939. A gold specimen from this mine is illustrated on Page 49.

Historical or Archival Collection

The purpose of this collection is to acquire and preserve significant mineral specimens and archival material from "historic" mines and quarries that are now closed. There is a concern on the part of the public about the state of our environment and the preservation of the earth's resources. With this collection we preserve specimens from mines and document the mines history.

Minerals are classified as non-renewable resources, and finely formed crystals have only been discovered in a limited number of localities. Many have been found as a direct result of mining and quarrying operations, and no doubt many have been destroyed by these same processes. Mines and quarries have a limited life span, and when they are no longer profitable they are filled in or are allowed to flood. When this occurs, the minerals that have been preserved in museums take on special historical significance as the only reference material that

researchers or the public may have from the closed mine or quarry.

Today most of the silver mined in the world is recovered as a byproduct of the lead-zinc-copper industry. Canada, however, has had two mining districts that produced large quantities of free or uncombined silver. These are the Cobalt mining camp in Ontario and the Port Radium camp on Great Bear Lake, Northwest Territories. Fine silver specimens from both camps are contained in our collections.

The Eldorado Mine at Port Radium is a significant part of Canada's history and had several connections to Alberta. Developed in the early 1930s it was the first major mine in the Northwest Territories, and it was the first to be discovered by prospectors making use of bushplanes.

The Eldorado mine was developed initially to recover radium and silver, but in World War II it was taken over by the Canadian government to produce uranium. The mine purchased and developed the Northern Transportation Company, an extensive fleet of ships and barges, to move its ore concentrates from Great Bear Lake to Waterways (Fort McMurray), the head of the railway. However, Edmontonian Leigh Brintnell started the Mackenzie Air Service and supplemented the barge system by flying concentrates from Port Radium to Fort McMurray.

Many of the fine silver specimens in our collections were obtained from Marleen Irwin through a local mineral dealer. Miss Irwin's father, the late James Irwin, was a mining engineer working at Port Radium and had brought the specimens out with him. Since his death the specimens had remained packed in cardboard boxes in his daughter's basement for several years. After contacting Miss Irwin directly, the

Museum received a further collection of mineral specimens from a variety of mines across Canada.

The most significant addition to the Historical Collections were the Bralorne gold samples that were acquired in late 1990 with the assistance of the Canadian Cultural Properties Export Review Board. On the basis of aesthetics, gold content, and total number of specimens this is the finest gold collection in Canada from a single locality.

The Bralorne mine (Figure 3), together with its neighbor the Pioneer mine, were the largest operations in the Bridge River mining camp of southwestern British Columbia and were the largest gold producers in Western Canada from the mid 1930s until 1971. In addition to the fine mineral specimens, the Museum acquired a collection of archival photographs and mine reports that document the history of mining in this area from the early 1900s to 1970.

The gold specimens from Bralorne in our collections (see Page 49) do not represent average ore from the mine, but rare pockets of very high gold concentrations. The average grade of ore for the mine was 0.5 ounces of gold for every ton of rock.

Interpretive Collection

This collection holds our most beautiful specimens and appeals to both the public and the professional mineralogist alike. The collection is world-wide in scope, containing well-formed crystals of common

5. A beautiful 123-carat aquamarine gemstone from Brazil.

minerals as well as rare, showy minerals found in only one or two localities.

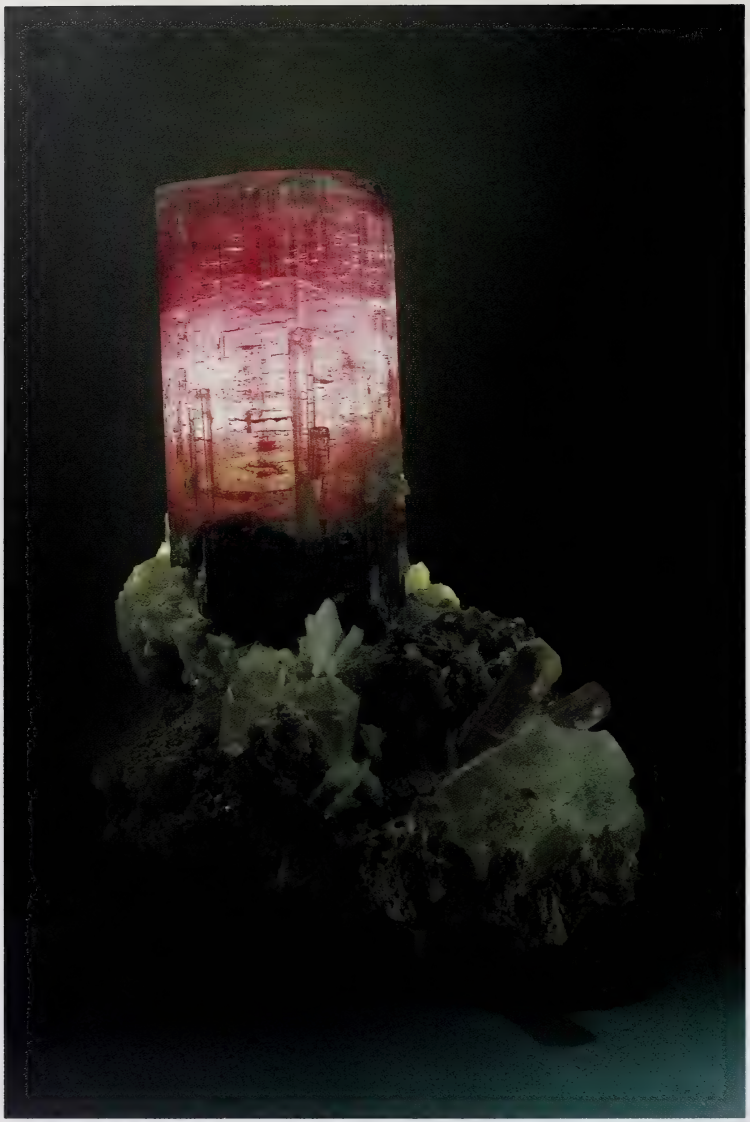
Beautiful minerals fascinate children and adults because of their diversity in form and color. Many people are aware that minerals are the sources of all of our metals and most of our gemstones. Gem varieties of minerals such as sapphires, rubies, and emeralds are prized because of their beauty, rarity, and durability.

The primary purpose of this collection is for the enjoyment and education of the public. For this reason we have acquired minerals of great beauty or specimens that illustrate a particular mineralogical phenomena, such as the variation of color in fluorite crystals or the variation in crystal shapes in pyrite. We have also sought to acquire outstanding specimens of metal ores such as the fine galena (lead sulphide) crystals from the Sweetwater Mine, Missouri. Other specimens include fine crystals of gemstone minerals, such as the pink elbaite from California (Figure 6), the pale blue aquamarine from Afghanistan, and the golden orange Imperial topaz from Brazil (Figure 4). The collection of unset gemstones, primarily from Brazil, is one of the finest display collections in Canada and includes outstanding examples of aquamarine (Figure 5), heliodor, morganite, topaz, elbaite, kunzite, and several others.

4. Imperial topaz crystal and 50-carat Imperial topaz gemstone from Brazil.

Canada is a major producer of base metals such as lead, zinc, and copper. Most of these metals are produced from unattractive, massive sulphide minerals. However, in some of the more arid parts of the world such as Arizona, Mexico, Namibia, and Australia, ground water carrying a variety of chemicals reacts with similar sulphide ores to produce new minerals, which often occur as well-formed crystals with brilliant colors. The public is often surprised to learn that these too are minerals of lead, zinc, and copper. A great variety of these minerals are included in the Exhibition collection.

A large portion of the geology collection is used in Museum exhibitions, both feature exhibitions exploring various themes in

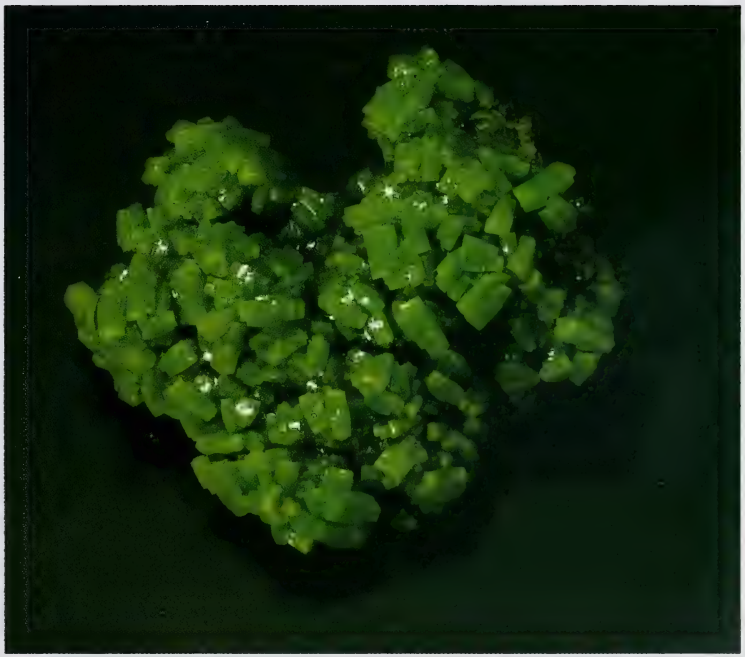


6. A fine pink elbaite crystal from the Stewart mine, Pala, California. Elbaite, a member of the tourmaline group of minerals, can occur in a great range of colors, many with their own gemstone names.

geology and permanent exhibitions such as the Mineral Gallery. Educational kits have been developed and sent out to schools to be used in teaching rock and mineral identification.

The collection is also the primary vehicle for curatorial research. Minerals from the historical collections have been the subject of a number of publications and are popular with collectors and scientists.

7. Cubes of purple fluorite on bladed barite crystals from Berbes, Spain.



8. Lustrous pyromorphite crystals from the Bunker Hill mine, Kellogg, Idaho, are highly prized by mineral collectors because of their beauty and rarity.

A SEASON OF MINERAL COLLECTING

Collecting Quartz Crystals Near Emerald Lake, Yukon

Rod and Helen Tyson

Rod Tyson hangs from a climbing rope to recover a quartz crystal.

At a party in September of 1980, we were shown some slides of a project one of the guests had worked on that summer. The slides were spectacular. Huge cliffs of granodiorite, pock-marked with cavities, looming over steep glaciers feeding a cold, blue-green lake. This was our first exposure to Emerald Lake in the eastern Yukon. The scenery alone was exciting, but what really intrigued us were the pictures of a single black quartz crystal weighing 120 pounds and measuring some thirty inches in length. Few places in the world produce well-crystallized quartz of this size. The best smoky quartz in the world is found in Switzerland. Here was a locality that might rival or even surpass the Swiss Alps.

During that winter one of us (Rod Tyson) travelled to Calgary to negotiate with AGIP Canada Ltd. for the right to visit their Fire, Ice, and Sun Claims near Emerald Lake. Unlike some other mining companies,

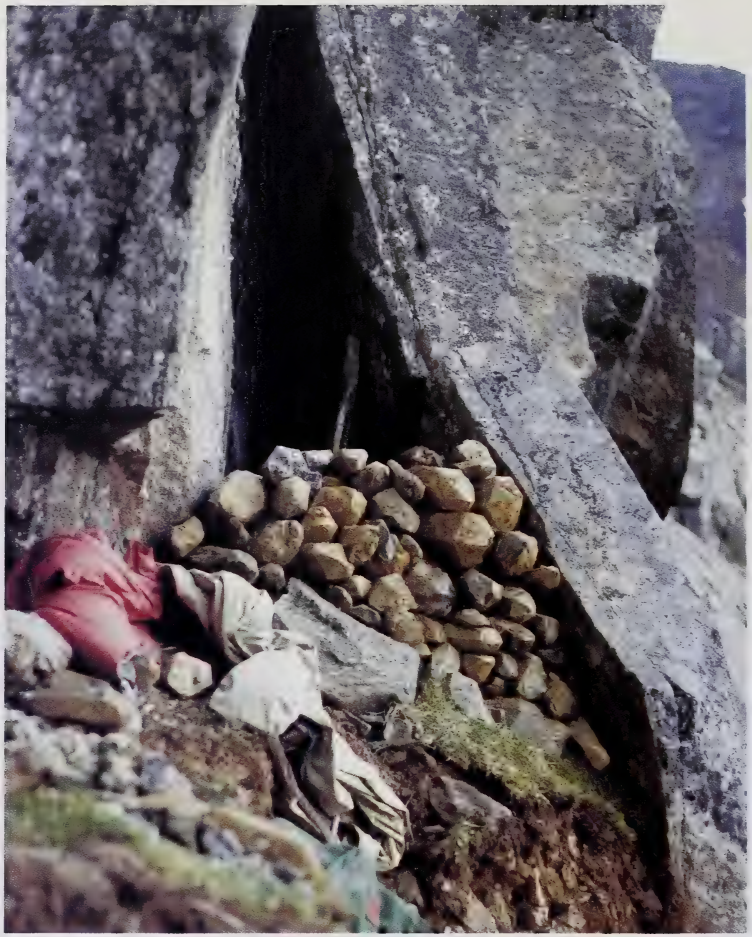
AGIP was enthusiastic about retrieving and preserving the mineral specimens on their claims. I arranged to visit the property in July 1981.

When July came, I invited Neal Pfaff, an American collector with experience in technical climbing, to accompany me to Emerald Lake. The first leg of our journey was the long drive up the Alaska Highway to Ross River. At Ross River, we boarded a small twin engine Cessna, which took us to MacMillan Pass. From the pass, we took a Hughes 500D helicopter to AGIP's camp on the shores of Emerald Lake.

The view from the helicopter was extraordinary, but I started to have an inkling of just how challenging this project might be.

After consulting Tom Garagon, the project geologist, we decided to pitch our camp at the base of the glacier that cut our target area in two. This camp would provide us with a direct route to both the areas we wanted to see, but every day it would entail a steep climb of a mile and a half over the rough glacier.

Helicopter preparing to lift a load of quartz crystals from an alpine perch.



Flat space is at a premium on a mountainside. Quartz crystals are stacked in a rock fracture to prevent them from rolling.

Our first ascent went smoothly but slowly. By early afternoon, we were just getting to a promising area when it started to rain. We could see AGIP's helicopter picking up their crews and decided that it would be wise for us to call it a day, too. So for our first day's effort, we had a long climb and not much else.

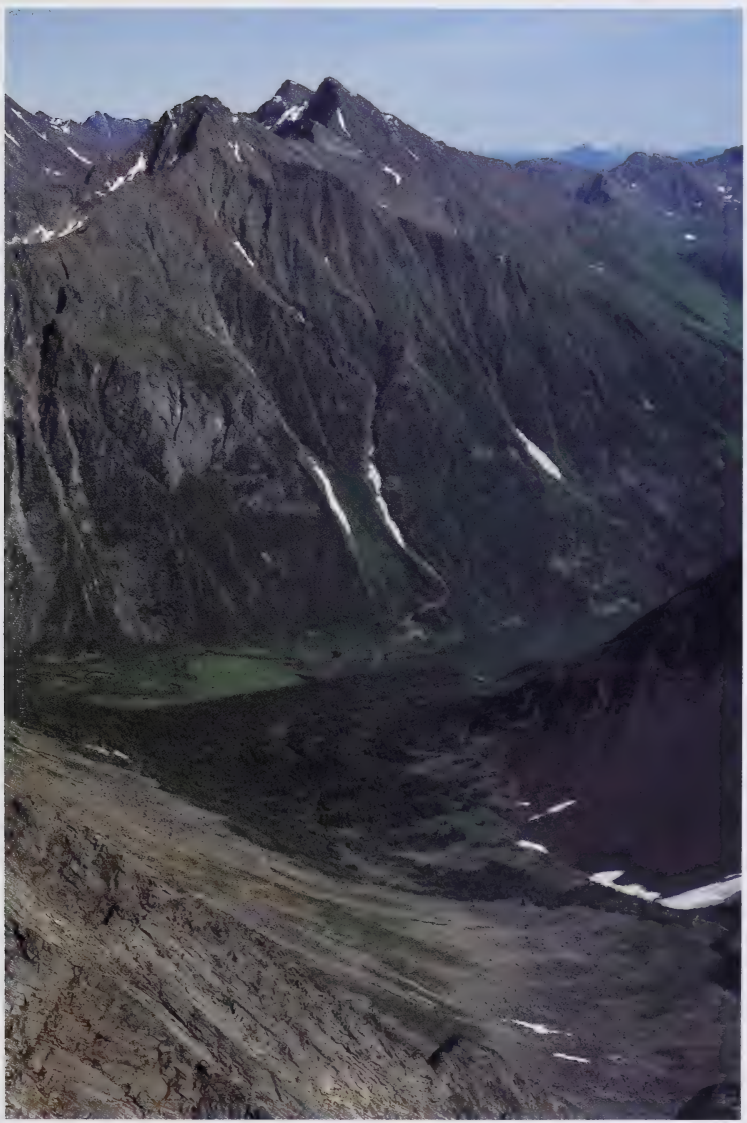
At breakfast the next morning we realized that ascent had to be a lot faster or we would never see half the cavities that hung above our camp. We chose the area farthest from us, to see how far we could get in one day. We repeated our climb of the day before, until we came to a Y junction in the glacier. We had hoped to ascend the right fork of the Y, but the rain had loosened so much rock that an ascent there was out of the question. Prudence being the order of the day, we ascended the easier, left-hand fork, at the end of which we literally walked into a pocket of smoky quartz crystals.

The crystals were covered in wet, rusty, sandy clay, impossible to remove in the field, but there was no mistaking the shapes. Quite a few of the quartz crystals were "sceptered," an overgrowth of the crystal's tip, highly prized by collectors. We dug in the pocket for several hours, piling up crystals and making a selection to haul down to camp. Quartz is heavy, and the rain had weakened some of the snow bridges over the glacier's crevasses. We could carry no more than fifteen pieces each on

every trip. We spent the rest of our week at Emerald Lake working in that one pocket, mining medium-sized crystals and transporting them back to camp.

One week was all we could afford for this first trip. We could not even finish that one pocket before we had to take the float plane back to Ross River.

Neal returned to Ohio and I returned to Edmonton, to begin the long task of cleaning off the rusty mud clinging to the surface of the crystals. The dark quartz proved to be highly sensitive to changes in temperature and greeted even short exposures to direct sunlight with a loud "crack," like the report of a rifle, which scattered shards of quartz in all directions. This temperamental behavior made the traditional method of cleaning quartz in hot oxalic acid impossible. Alternate scrubbing and soaking in muriatic acid proved a workable alternative.



Rugged alpine terrain, Emerald Lake, Yukon, Territory.

Unfortunately, when cleaned, about two thirds of our haul displayed heavily pitted surfaces that did not resemble anything the Swiss Alps have produced. None of our treasures really could be said to be beautiful, but about twenty *per cent* had an unexpected payoff: a rare mineral called kobellite, deeply included in the body of the crystals.

Over the winter I looked long and hard at what we had done at Emerald Lake. Camping at the base of the glacier meant that too much time was spent traversing the ice and not enough collecting crystals. This was especially true now that the crystals' worth appeared to reside in size, shape, and rarity rather than beauty. I was determined to try another season at Emerald Lake, refining my techniques based on what I had learned.

In the summer of 1982 I returned to the lake with another technical climber, Henry Bommer, who has had experience in the Alps. This time, we put our base camp at an elevation of 6,000 feet, just above the highest part of the glacier and right in the middle of the area we had collected the year before. When our tent was pitched inside a pocket of quartz, there was no space left to walk around. When we left the tent each morning, the land was straight up or straight down, with no place to stretch and admire the view.

This time, we reached about twenty pockets of quartz, many of them filled with ice. Usually the quartz was smoked or solid black, but again, none could touch the lovely clear, smooth quartz from Switzerland. We spent one week collecting, our last at Emerald Lake. Of all the quartz we found, that from our first pocket of 1981 proved to be the best.

Mineral collecting is a chancy business, like any mining venture. Emerald Lake did not fulfill our wildest dreams, but overall it was a success. We collected about 1,000 pounds of crystals. One of the largest, about twenty-five pounds and eighteen inches long, now resides in the Canadian Museum of Nature. Another, with spectacular crystal form, is in the Royal Ontario Museum. Others are in the collections of the Provincial Museum of Alberta.

We have collected in other localities in the far north: pyrite in Baffin Island, silver at Port Radium. Emerald Lake, however, yielded the largest single crystals we have ever collected. There were many, many pockets we could not explore. I still wonder what they hold.

Contributors

Catherine C. Cole, Curator of Social History, is responsible for the Social History collection of the Provincial Museum of Alberta. She holds a master's degree in history from the University of Alberta and is currently pursuing doctoral studies at the University of Leicester, England. She is editor of *Norwegian Immigrant Clothing and Textiles* (1990) and the author of several monographs on the history of garment manufacturing in Western Canada.

David J. Goa, Curator of Folk Life, is responsible for the Folk Life collection at the Provincial Museum of Alberta. He is also Research Fellow of the Calgary Institute for the Humanities, and an Adjunct Professor in Religious Studies, University of Alberta. He is the author of numerous articles and books on the symbolic life of human cultures.

Robert S. Kidd is Curator of Archaeology at the Provincial Museum of Alberta. He is the author of several monographs on Alberta archaeology and has an interest in the history of coinage.

Ron Mussieux is Curator of Geology at the Provincial Museum of Alberta. He is a graduate of the University of Alberta with degrees in Geology and Education. Since 1974 he has built the Museum's superb collection of minerals and of historic specimens and archival materials associated with the mining industry.

Craig Sobat, graduate of the University of Alberta, has been an avid collector of Asian art for some years. In 1990 he was guest curator of *Treasures in Oriental Porcelain, selections from The Ernest E. and Gertrude Poole Collection*, an exhibition of the Provincial Museum of Alberta.

Rod and Helen Tyson are the partners of Tyson's Fine Minerals Inc., an Alberta-based company that specializes in exploring for, collecting, preparing, and selling well-crystallized mineral specimens. Their clientele includes collectors, dealers, and museums from North and South America, Europe, Australia, Asia, and Africa.

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